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EBASCO

# ARCS II PROGRAM

## Remedial Planning Activities at Selected Uncontrolled Hazardous Substance Disposal Sites Within EPA Region II (NY, NJ, PR, VI)

FINAL
SCREENING SITE INSPECTION (SSI)
CAPTAIN'S COVE CONDOMINIUM SITE
GLEN COVE, NASSAU COUNTY NEW YORK

SEPTEMBER 1995

VOLUME III OF V

*EPA Contract 68-W8-0110*

EBASCO

*An ENSERCH® Engineering and Construction Company*

EPA WORK ASSIGNMENT NO: 076-2JZZ
EPA CONTRACT NO: 68-W8-0110
EBASCO SERVICES INCORPORATED
ARCS II PROGRAM

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REFERENCE NO. 26

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# Probability and Statistics for Engineering and the Sciences

SECOND EDITION

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California Polytechnic State University
San Luis Obispo

**Brooks/Cole Publishing Company**
Monterey, California

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# Contents

appear as though a randomly selected Justice can be expected to serve 10 years or more? Justify your answer.

10. An article in *Environmental Concentration and Toxicology* ("Trace Metals in Sea Scallops," vol. 19, pp. 326–1334) reported the amount of cadmium in sea scallops observed at a number of different stations in North Atlantic waters. The observed values follow:

    5.1, 14.4, 14.7, 10.8, 6.5, 5.7, 7.7, 14.1, 9.5, 3.7, 8.9, 7.9, 7.9, 4.5, 10.1, 5.0, 9.6, 5.5, 5.1, 11.4, 8.0, 12.1, 7.5, 8.5, 13.1, 6.4, 18.0, 27.0, 18.9, 10.8, 13.1, 8.4, 16.9, 2.7, 9.6, 4.5, 12.4, 5.5, 12.7, 17.1

    a. Construct a frequency and relative frequency distribution for the data set using 0.0–under 4.0 as the first class interval.

    b. Draw a histogram corresponding to the distributions of (a) so that area = relative frequency.

11. If in Example 1.5 the relative frequencies are computed to only two decimal places, do they add up to 1?

12. In a study of warp breakage during the weaving of fabric (*Technometrics*, 1982, p. 63), 100 pieces of yarn were tested. The number of cycles of strain to breakage was recorded for each yarn sample. The resulting data is given below.

    86, 146, 251, 653, 98, 249, 400, 292, 131, 169, 175, 176, 76, 264, 15, 364, 195, 262, 88, 264, 157, 220, 42, 321, 180, 198, 38, 20, 61, 121, 282, 224, 149, 180, 325, 250, 196, 90, 229, 166, 38, 337, 65, 151, 341, 40, 40, 135, 597, 246, 211, 180, 93, 315, 353, 571, 124, 279, 81, 186, 497, 182, 423, 185, 229, 400, 338, 290, 398, 71, 246, 185, 188, 568, 55, 55, 61, 244, 20, 284, 393, 396, 203, 829, 239, 236, 286, 194, 277, 143, 198, 264, 105, 203, 124, 137, 135, 350, 193, 188

    a. Using class intervals 0–<100, 100–<200, and so on, construct a relative frequency distribution for breaking strength.

    b. If weaving specifications require a breaking strength of at least 100 cycles, what proportion of the yarn samples would be considered satisfactory?

13. Every score in the following batch of exam scores is in the 60's, 70's, 80's, or 90's. A stem and leaf display with only the four stems 6, 7, 8, and 9 would not give a very detailed description of the distribution of scores. In such situations it is desirable to use repeated stems. Here we could repeat the stem 6 twice, using 6*l* for scores in the low 60's (leaves 0, 1, 2, 3, and 4) and 6*h* for scores in the high 60's (leaves 5, 6, 7, 8, and 9). Similarly, the other stems can be repeated twice (7*l*, 7*h*, 8*l*, 8*h*, 9*l*, and 9*h*) to obtain a display consisting of eight rows. Construct such a display for the given scores. What feature of the data is highlighted by this display?

    74, 89, 80, 93, 64, 67, 72, 70, 66, 85, 89, 81, 81, 71, 74, 82, 85, 63, 72, 81, 81, 95, 84, 81, 80, 70, 69, 66, 60, 83, 85, 98, 84, 68, 90, 82, 69, 72, 87, 88

14. For quantitative data, the **cumulative frequency** and cumulative relative frequency for a particular class interval are the sum of frequencies and relative frequencies, respectively, for that interval and all intervals lying below it. If, for example, there are four intervals with frequencies 9, 16, 13, and 12, then the cumulative frequencies are 9, 25, 38, and 50 and the cumulative relative frequencies are .18, .50, .76, and 1.00. Compute the cumulative frequencies and cumulative relative frequencies for the data of Exercise 7.

## 1.3 Measures of Location

Having briefly studied tabular and pictorial methods for organizing and summarizing data, in this section and the next we will focus on numerical summary measures for a given data set. That is, from the data we try to extract several summarizing numbers, numbers that might serve to characterize the data set and convey some of its salient features. Our primary concern will be with numerical data, though some comments regarding categorical data appear at the end of the section.

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Suppose, then, that our data set is of the form $x_1, x_2, \ldots, x_n$, where each $x_i$ is a number. What features of such a set of numbers are of most interest and deserve emphasis? One important characteristic of a set of numbers is its location, and in particular its center. This section presents methods for describing the location of a data set, while in Section 1.4 we will turn to methods for measuring the variability in a set of numbers.

### The Mean

For a given set of numbers $x_1, x_2, \ldots, x_n$, the most familiar and useful measure of the center is the mean, or arithmetic average of the set. Because we will almost always think of the $x_i$'s as constituting a sample, we will often refer to the arithmetic average as the **sample mean** and denote it by $\bar{x}$.

Definition

The **sample mean** $\bar{x}$ of a set of numbers $x_1, x_2, \ldots, x_n$ is given by

$$\bar{x} = \frac{x_1 + x_2 + \cdots + x_n}{n} = \frac{\sum_{i=1}^{n} x_i}{n}$$

The value of $\bar{x}$ is in a sense more precise than the accuracy associated with any single observation. For this reason, we will customarily report the value of $\bar{x}$ using one digit of decimal accuracy beyond what is used in the individual $x_i$'s.

Example **1.7**

The amount of light reflectance by leaves has been used for various purposes, including evaluation of turf color, estimation of nitrogen status, and measurement of biomass. The paper "Leaf Reflectance-Nitrogen-Chlorophyll Relations in Buffelgrass" (*Photogrammetric Engineering and Remote Sensing*, 1985, pp. 463–466) gave the following observations, obtained using spectrophotogrammetry, on leaf reflectance under specified experimental conditions:

15.2, 16.8, 12.6, 13.2, 12.8, 13.8, 16.3, 13.0, 12.7, 15.8, 19.2, 12.7, 15.6, 13.5, 12.9

The sum of these 15 $x_i$'s is $\Sigma x_i = 15.2 + 16.8 + \cdots + 12.9 = 216.1$, so the value of the sample mean is

$$\bar{x} = \frac{\sum_{i=1}^{15} x_i}{15} = \frac{216.1}{15} = 14.41 \qquad \blacksquare$$

A physical interpretation of $\bar{x}$ will demonstrate how it measures the location (center) of a sample. Think of drawing and scaling a horizontal measurement axis, and then represent each sample observation by a one-pound weight placed at the corresponding point on the axis. The only point at which a fulcrum can be placed to balance the system of weights is the point corresponding to the value of $\bar{x}$ (see Figure 1.6).

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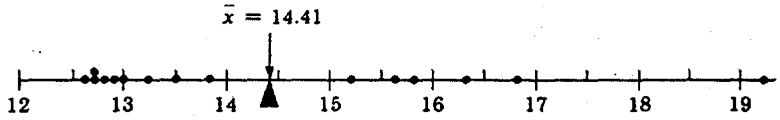


**Figure 1.6** The mean as the balance point for a system of weights

Just as $\bar{x}$ represents the average value of the observations in a sample, the average of all values in the population can be calculated. This average is called the **population mean** and is denoted by the Greek letter $\mu$. When there are $N$ values in the population (a finite population), then $\mu =$ (sum of the $N$ population values)$/N$.

Example **1.8** Exercise 9 listed the length of service of each U. S. Supreme Court Justice whose service terminated before 1978. Regarding these $N = 94$ numbers as constituting the population of interest, the population mean is

$$\mu = \frac{5 + 1 + 20 + \cdots + 3 + 4}{94} = \frac{1406}{94} = 15.0$$

If a sample of size $n = 5$ is selected and the result is $x_1 = 8$, $x_2 = 23$, $x_3 = 16$, $x_4 = 7$, and $x_5 = 18$, then the sample mean is $\bar{x} = 14.4$. If we did not know $\mu$, we could estimate it as 14.4, the value of the sample mean. ■

In Chapters 3 and 4 we will discuss models for infinite populations, so we will postpone until then a general definition of $\mu$. Just as $\bar{x}$ is an interesting and important measure of sample location, $\mu$ is an interesting and important (often the most important) characteristic of a population. In the chapters on statistical inference, we will present methods based on the sample mean for drawing conclusions about a population mean. For example, we might use the sample mean $\bar{x} = 14.41$ computed in Example 1.7 as a point estimate (a single number which is our "best" guess) of $\mu =$ the true average reflectance for all leaves under the specified conditions.

The sample mean does possess one property that renders it a somewhat unsatisfactory measure of location for some data sets. The computed value of $\bar{x}$ can be greatly influenced by the presence of just one observation that lies very far to one side or the other of the other values.

Example **1.9** Suppose that we randomly select five recordings of classical music from the *Schwann Record Catalog* (which lists all current recordings of classical and nonclassical music), and determine the listening time for each. If the data values are (rounded to the nearest minute) $x_1 = 37$, $x_2 = 46$, $x_3 = 40$, $x_4 = 57$, and $x_5 = 50$, then $\bar{x} = 46.0$ minutes. However, if the fifth recording selected is not a Tchaikovsky symphony but instead a Wagner opera, so that $x_5 = 200$ (and seems much longer), then $\bar{x} = 76$. Since most of the data values are considerably smaller than 76, many would feel that $\bar{x}$ here is not a reliable

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**20.** The propagation of fatigue cracks in various aircraft parts has been the subject of extensive study in recent years. The accompanying data consists of propagation lives (flight hours/$10^4$) to reach a given crack size in fastener holes intended for use in military aircraft ("Statistical Crack Propagation in Fastener Holes under Spectrum Loading," *J. Aircraft,* 1983, pp. 1028–1032).

.736, .863, .865, .913, .915, .937, .983, 1.007, 1.011, 1.064, 1.109, 1.132, 1.140, 1.153, 1.253, 1.394

**a.** Compute the values of the sample mean and median.

**b.** By how much could the largest sample observation be decreased without affecting the value of the median?

**21.** Compute the sample median, 25% trimmed mean, 10% trimmed mean, and sample mean for the data given in Exercise 10.

**22.** In an attempt to study the effect of choice of postage stamps on response rate in a mail survey, W. E. Hensley (*Public Opinion Quarterly,* vol. 38, pp. 280–283), reported the following data on number of mailings $n_i$ and number of returns $x_i$ both when inside and outside stamps were dissimilar ($i = 1$) and similar ($i = 2$): $n_1 = 354$, $x_1 = 217$, $n_2 = 176$, $x_2 = 89$.

**a.** Compute the sample proportion of returns both for dissimilar stamps and similar stamps.

**b.** The sample proportions of (a) can be viewed as estimates of true return proportions $p_1$ and $p_2$ for hypothetical populations. If there is actually no difference in response rate due to the types of stamps, then $p_1 = p_2$, and we have a sample of size $n = 354 + 176 = 530$ from a single hypothetical population, with $x = 306$ returns. Compute the sample proportion for this pooled (combined) sample.

**23.** In Exercise 17, obtain the sample proportion of insurance companies that charge at least \$350 for such policies. What is the sample proportion of companies that charge between \$300 and \$350 inclusive?

**24. a.** If a constant $c$ is added to each $x_i$ in a sample, yielding $y_i = x_i + c$, how do the sample mean and median of the $y_i$'s relate to the mean and median of the $x_i$'s?

**b.** If each $x_i$ is multiplied by a constant $c$, yielding $y_i = cx_i$, answer the question of part (a).

## 1.4 Measures of Variability

No single measure of location can give a complete summarization of a data set. Consider the $x$ data set 20, 100, 0, 60, 70 and the $y$ data set 60, 20, 80, 60, 30. Since $\bar{x} = \bar{y} = 50$ and $\tilde{x} = \tilde{y} = 60$, the two standard measures of location by themselves do not distinguish between the two sets. Yet the plots of these two data sets in Figure 1.9 show that the observations in the $y$ data set cluster more closely about their center than do the observations from the $x$ data set. That is, there is more variability or dispersion in the $x$'s than in the $y$'s.

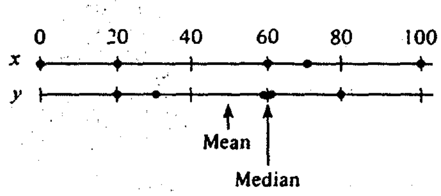


**Figure 1.9** Data sets with the same center and differing variability

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One simple measure of variability is the **sample range**, defined as the difference between the largest observation and the smallest observation—that is, sample range $= \max(x_i) - \min(x_i)$. We might then say that a small (large) range indicates little (great) variability. A defect of the sample range, though, is that it depends only on the two most extreme observations and disregards the positions of the middle observations. For example, the two samples 0, 5, 5, 5, 10 and 0, 1, 5, 9, 10 both have the same sample range, yet in the first sample there is variability only in the two extreme values, while the second sample has more variability in its middle values. We would like a measure that somehow depends on all observations rather than just a few.

### Deviations from the Mean

The quantity $x_i - \bar{x}$ is called the deviation of the $i$th observation from the mean, or just the ***i*th deviation.** A positive deviation indicates an observation to the right of $\bar{x}$ on the measurement axis, while a negative deviation indicates an observation to the left of $\bar{x}$. If all the deviations $x_1 - \bar{x}, \ldots, x_n - \bar{x}$ are small in absolute magnitude, then all $x_i$'s are close to $\bar{x}$ and thus to one another, suggesting a relatively small amount of variability in the sample. On the other hand, if some of the $(x_i - \bar{x})$'s are large in absolute magnitude, then some of the $x_i$'s lie far from $\bar{x}$, suggesting large variation. A simple way of combining the $n$ deviations into a single quantity is to average them (sum them and divide by $n$). However, since some deviations will be negative and others positive, adding results in cancellation.

Proposition

$$\sum_{i=1}^{n} (i\text{th deviation}) = \sum_{i=1}^{n} (x_i - \bar{x}) = 0$$

so the average deviation from the mean is always 0.

**Proof.** The verification uses several standard rules of summation and the fact that $\bar{x}$ is a constant in the summation:

$$\Sigma (x_i - \bar{x}) = \Sigma x_i - \Sigma \bar{x} = \Sigma x_i - n\bar{x} = \Sigma x_i - n\left(\frac{1}{n}\Sigma x_i\right) = 0 \qquad \blacksquare$$

To obtain an informative measure of variability, we need to change the deviations to nonnegative quantities before combining. One possibility is to average the absolute deviations $|x_1 - \bar{x}|, \ldots, |x_n - \bar{x}|$. Because this leads to a multitude of theoretical difficulties, consider instead the squared deviations $(x_1 - \bar{x})^2, \ldots, (x_n - \bar{x})^2$. We might now use the average of the squared deviations. There is, however, a technical reason (to be discussed shortly) for dividing the sum of squared deviations by $n - 1$ rather than $n$.

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### The Sample Variance and Standard Deviation

Definition

> The **sample variance** of the set $x_1, \ldots, x_n$ of numerical observations, denoted by $s^2$, is given by
>
> $$s^2 = \frac{\sum_{i=1}^{n}(x_i - \overline{x})^2}{n-1}$$
>
> The **sample standard deviation,** denoted by $s$, is the positive square root of the sample variance.

The divisor $n - 1$ in $s^2$ is smaller than $n$, so $s^2$ is somewhat larger than the average squared deviation. Whatever the units in which the $x_i$'s are expressed, $s^2$ is given in squared units (e.g., in.$^2$ when the $x_i$'s are heights in inches, sec$^2$ when observations are stopping times expressed in seconds, and so on). The sample standard deviation has the desirable property of measuring dispersion in units identical to those in which the $x_i$'s themselves are given.

Example **1.12** Strength is an important characteristic of materials used in prefabricated housing. Each of $n = 11$ prefabricated plate elements was subjected to a severe stress test and the maximum width (mm) of the resulting cracks was recorded. The given data (Table 1.3) appeared in the paper "Prefabricated Ferrocement Ribbed Elements for Low-Cost Housing" (*J. Ferrocement,* 1984, pp. 347–364).

**Table 1.3**

| $x_i$ | $x_i - \overline{x}$ | $(x_i - \overline{x})^2$ |
|---|---|---|
| .684 | −.9841 | .9685 |
| 2.540 | .8719 | .7602 |
| .924 | −.7441 | .5537 |
| 3.130 | 1.4619 | 2.1372 |
| 1.038 | −.6301 | .3970 |
| .598 | −1.0701 | 1.1451 |
| .483 | −1.1851 | 1.4045 |
| 3.520 | 1.8519 | 3.4295 |
| 1.285 | −.3831 | .1468 |
| 2.650 | .9819 | .9641 |
| 1.497 | −.1711 | .0293 |
| $\Sigma x_i = 18.349$ | $\Sigma(x_i - \overline{x}) = -.0001$ | $\Sigma(x_i - \overline{x})^2 = 11.9359$ |
| $\overline{x} = \frac{18.349}{11} = 1.6681$ | | |

Effects of rounding account for the sum of deviations not being exactly zero. The numerator of $s^2$ is 11.9359, so $s^2 = 11.9359/(11 - 1) = 11.9359/10 = 1.19359$ and $s = \sqrt{1.19359} = 1.0925$ mm. ■

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Admittedly $s^2$ and $s$ do not lend themselves to the intuitive understanding that measures of location do. Because variability is a less familiar characteristic than is location, the usefulness of measures of variability is less obvious. In particular, we are not in a position to say that $s = 1.9025$ indicates a large or a small amount of variability. All you should believe at this point is that if "eyeballing" two different samples suggests that the first clearly has less variability than the second, then $s^2$ and $s$ for the first sample should be smaller than the corresponding quantities for the second sample.

### Motivation for $s^2$

In order to explain why $s^2$ rather than the average squared deviation is used to measure variability, note first that whereas $s^2$ measures sample variability, there is a measure of variability in the population called the population variance. We shall use $\sigma^2$ (the square of the lowercase Greek letter sigma) to denote the population variance and $\sigma$ to denote the population standard deviation (the square root of $\sigma^2$). When the population is finite and consists of $N$ values, $\sigma^2 = \Sigma$ ($i$th population value $- \mu)^2/N$, which is the average of all squared deviations from the population mean (for the population, the divisor is $N$ and not $N - 1$). More general definitions of $\sigma^2$ appear in Chapters 3 and 4.

Just as $\bar{x}$ will be used to make inferences about the population mean $\mu$, we should define the sample variance so that it can be used to make inferences about $\sigma^2$. Now note that $\sigma^2$ involves squared deviations about the population mean $\mu$. If we actually knew the value of $\mu$, then we could define the sample variance as the average squared deviation of the sample $x_i$'s about $\mu$. However, the value of $\mu$ is almost never known, so the sum of squared deviations about $\bar{x}$ must be used. But *the $x_i$'s tend to be closer to their average $\bar{x}$ than to the population average $\mu$, so to compensate for this the divisor $n - 1$ is used rather than $n$.* Said another way, if we used a divisor $n$ in the sample variance, then the resulting quantity would tend to underestimate $\sigma^2$ (produce estimated values that are too small on the average), while dividing by the slightly smaller $n - 1$ corrects this underestimating.

It is customary to refer to $s^2$ as being based on $n - 1$ **"degrees of freedom."** This terminology results from the fact that while $s^2$ is based on the $n$ quantities $x_1 - \bar{x}, x_2 - \bar{x}, \ldots, x_n - \bar{x}$, these sum to 0, so specifying the values of any $n - 1$ of the quantities determines the remaining one. For example, if $n = 4$ and $x_1 - \bar{x} = 8$, $x_2 - \bar{x} = -6$, and $x_4 - \bar{x} = -4$, then automatically we have $x_3 - \bar{x} = 2$, so only three of the four $x_i - \bar{x}$'s are freely determined (3 degrees of freedom).

### The Computation of $s^2$

With $n$ observations the computation of $s^2$ from the definition involves $n$ subtractions and $n$ squaring operations. If $\bar{x}$ is not an integer, the subtractions to obtain the deviations can be tedious, and the deviations themselves may be unpleasant to square. There is an equivalent expression for the numerator of $s^2$ that yields a more efficient method for calculating $s^2$ when computations are done by hand or hand-held calculator.

**Proposition**

$$s^2 = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2}{n-1} = \frac{\sum_{i=1}^{n} x_i^2 - \left(\sum_{i=1}^{n} x_i\right)^2 / n}{n-1}$$

**Proof.** Because $\bar{x} = \Sigma x_i/n$, $n\bar{x}^2 = (\Sigma\, x_i)^2/n$. Then

$$\sum_{i=1}^{n}(x_i - \bar{x})^2 = \sum_{i=1}^{n}(x_i^2 - 2\bar{x}\cdot x_i + \bar{x}^2) = \sum_{i=1}^{n} x_i^2 - 2\bar{x}\sum_{i=1}^{n} x_i + \sum_{i=1}^{n}(\bar{x})^2$$

$$= \sum_{i=1}^{n} x_i^2 - 2\bar{x}\cdot n\bar{x} + n(\bar{x})^2 = \sum_{i=1}^{n} x_i^2 - n(\bar{x})^2$$

$$= \sum_{i=1}^{n} x_i^2 - \frac{\left(\sum_{i=1}^{n} x_i\right)^2}{n} \qquad \blacksquare$$

To use this method for computing $s^2$, square each $x_i$ (before subtraction), then add the squares, and subtract $(\Sigma\, x_i)^2/n$ from $\Sigma\, x_i^2$. While this involves squaring $n + 1$ numbers ($\Sigma\, x_i$ in addition to each $x_i$), only one subtraction is necessary. We shall refer to this formula for computing $s^2$ as the "shortcut method for $s^2$." The shortcut for $s$ involves computing $s^2$ using the shortcut and then taking the square root.

**Example 1.13** Table 1.4 displays the $n = 15$ reflectance observations first introduced in Example 1.7.

**Table 1.4**

| *Observation* | $x_i$ | $x_i^2$ |
|---|---|---|
| 1 | 15.2 | 231.04 |
| 2 | 16.8 | 282.24 |
| 3 | 12.6 | 158.76 |
| 4 | 13.2 | 174.24 |
| 5 | 12.8 | 163.84 |
| 6 | 13.8 | 190.44 |
| 7 | 16.3 | 265.69 |
| 8 | 13.0 | 169.00 |
| 9 | 12.7 | 161.29 |
| 10 | 15.8 | 249.64 |
| 11 | 19.2 | 368.64 |
| 12 | 12.7 | 161.29 |
| 13 | 15.6 | 243.36 |
| 14 | 13.5 | 182.25 |
| 15 | 12.9 | 166.41 |
| | $\Sigma\, x_i = 216.1$ | $\Sigma\, x_i^2 = 3168.13$ |

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Thus the shortcut formula gives

$$s^2 = \frac{\Sigma x_i^2 - \frac{(\Sigma x_i)^2}{n}}{n-1} = \frac{3168.13 - \frac{(216.1)^2}{15}}{15-1} = \frac{54.85}{14} = 3.92$$

and $s = \sqrt{3.92} = 1.98$. ■

The shortcut method can yield values of $s^2$ and $s$ that differ from the values computed using the definitions. These differences are due to effects of rounding and will not be important in most problems. In order to minimize the effects of rounding when using the shortcut formula, particularly when there is little variability in the data, intermediate calculations should be done using several more significant digits than are to be retained in the final answer. Because the numerator of $s^2$ is the sum of nonnegative quantities (squared deviations), $s^2$ is guaranteed to be nonnegative. Yet if the shortcut method is used, particularly with data having little variability, a slight numerical error can result in a negative numerator ($\Sigma x_i^2$ smaller than $(\Sigma x_i)^2/n$). If your value of $s^2$ is negative you have made a computational error.

There are several other properties of $s^2$ that can sometimes be used to increase computational efficiency. These are summarized in the following proposition.

**Proposition**

Let $x_1, x_2, \ldots, x_n$ be a sample and $c$ be any nonzero constant.

1. If $y_1 = x_1 + c, y_2 = x_2 + c, \ldots, y_n = x_n + c$, then $s_y^2 = s_x^2$, and
2. If $y_1 = cx_1, \ldots, y_n = cx_n$, then $s_y^2 = c^2 s_x^2$, $s_y = |c|s_x$,

where $s_x^2$ is the sample variance of the $x$'s and $s_y^2$ is the sample variance of the $y$'s.

In words, (1) says that if a constant $c$ is added to (or subtracted from) each data value, the variance is unchanged. This is intuitive, since adding or subtracting $c$ shifts the location of the data set but leaves distances between data values unchanged. According to (2), multiplication of each $x_i$ by $c$ results in $s^2$ being multiplied by a factor of $c^2$. These properties can be proved by noting in (1) that $\bar{y} = \bar{x} + c$ and in (2) that $\bar{y} = c\bar{x}$.

**Example 1.14** Recall the spacecraft data (Example 1.2) $x_1 = 81.3001$, $x_2 = 81.3015$, $x_3 = 81.3006$, $x_4 = 81.3011$, $x_5 = 81.2997$, $x_6 = 81.3005$, and $x_7 = 81.3021$. If we subtract the smallest value 81.2997 from all observations, the resulting values are .0004, .0018, .0009, .0014, .0000, .0008, and .0024; the variance of this set is the same as that of the original data and is easier to compute. Now if we multiply each value by 10,000, the variance of the resulting set is $(10{,}000)^2$ times the original variance. The new data set is 4, 18, 9, 14, 0, 8, and 24 with mean 11.0 and sum of squares 1257, so the variance is $[1257 - (77)^2/7]/6 =$

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12.F.d

68.33. The variance of the original data set is therefore $68.33/(10{,}000)^2 = .0000006833$. ■

**Boxplots**

Stem and leaf displays and histograms convey rather general impressions about a data set, whereas a single summary such as the mean or standard deviation focuses on just one aspect of the data. In recent years, a pictorial summary called a *boxplot* has been used successfully to describe several of a data set's most prominent features. These features include (a) center, (b) spread, (c) the extent and nature of any departure from symmetry, and (d) identification of "outliers," observations that lie unusually far from the main body of the data. Because even a single outlier can drastically affect the value of some numerical summaries (such as $\bar{x}$ and $s$), a boxplot is based on measures that are "resistant" to the presence of a few outliers—the median and a measure of spread called the *fourth spread.*

Definition

After ordering the $n$ observations in a data set from smallest to largest, the **lower fourth** and **upper fourth** are given by

$$\text{lower fourth} = \begin{cases} \text{median of the smallest } n/2 \text{ observations} & n \text{ even} \\ \text{median of the smallest } (n+1)/2 \text{ observations} & n \text{ odd} \end{cases}$$

$$\text{upper fourth} = \begin{cases} \text{median of the largest } n/2 \text{ observations} & n \text{ even} \\ \text{median of the largest } (n+1)/2 \text{ observations} & n \text{ odd} \end{cases}$$

That is, the lower (upper) fourth is the median of the smallest (largest) half of the data, where the median $\tilde{x}$ is included in both halves if $n$ is odd. A measure of spread that is resistant to outliers is the **fourth spread** $f_s$, given by

$$f_s = \text{upper fourth} - \text{lower fourth}$$

Roughly speaking, the fourth spread is unaffected by the positions of those observations in the smallest 25% or the largest 25% of the data.

A boxplot can now be constructed via the following sequence of steps:

1. Draw and mark a horizontal measurement axis.
2. Construct a rectangle whose left edge lies above the lower fourth and whose right edge lies above the upper fourth.
3. Draw a vertical line segment inside the box above the median.
4. Extend lines from each end of the box out to the furthest observations that are still within $1.5f_s$ of the corresponding edges.
5. Draw an open circle to identify each observation that falls between $1.5f_s$ and $3f_s$ from the edge to which it is closest; these are called **mild outliers.**
6. Draw a solid circle to identify each observation that falls more than $3f_s$ from the closest edge; these are called **extreme outliers.**

REFERENCE NO. 27

SURFACE AND SUBSURFACE SOILS OBTAINED AT CAPTAIN'S COVE CONDOMINIUM SITE
(ALL RESULTS IN MG/KG)

| | | | CAPTAIN'S COVE SURFACE S SOILS | | CAPTAIN'S COVE SUBSURFACE SOILS | |
|---|---|---|---|---|---|---|
| CONTAMINANT | CC-SS11-02 (BACKGROUND TAKEN AT 0-6") | CC-SS11-02 (BACKGROUND TAKEN AT 4') | CC-SS14-01 | CC-SS15-01 (DUPLICATE OF CC-SS14-01) | CC-SS12-01 | CC-SS13-01 |
| TUNGSTEN | 185 J | 1.4 J | 3,200 J | 3,820 J | 51 | 1,210 J |

SURFACE SOIL OBTAINED AT LI TUNGSTEN SITE
(ALL RESULTS IN MG/KG)

| CONTAMINANT | CC-SS11-02 (BACKGROUND TAKEN AT 0-6") | LT-SS01-01 | LT-SS02-01 | LT-SS03-01 | LT-SS04-01 | LT-SS05-01 | LT-SS05-01D |
|---|---|---|---|---|---|---|---|
| TUNGSTEN | 185 J | 3,050 J | 16,200 J | 1,160 J | 4,540 J | 1,160 | 1,420 J |

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CAPTAIN'S COVE
DATA VALIDATION REPORT
TUNGSTEN

Prepared by: Cecelia N. Minch

Cecelia N. Minch

Date: 7/1/95

102940

# BRIDGEPORT RENTAL AND OIL SERVICES
# DATA VALIDATION REPORT

## SUMMARY:

This case consisted of 2 aqueous field blanks and 12 soil samples collected on April 20, 1995 and designated for the analysis of tungsten by ICP-MS method 200.8. One field duplicate pair (LTSS05-01/05D) was collected and analyzed with satisfactory results. All soil results were reported on a dry weight basis. The % solid reported for sample CC-SS11-02 in this package was greater than 50%. However, the data user should be aware that in the report drafted for the metals analysis performed by IEANJ, the % solid was less than 50%. No action was taken.
Although a CLP package format was requested, several of the usual QC analyses were not performed since they are not specified in the method. In addition, since tungsten (W) is not listed on the target analyte list of the method, no CRDL was defined.
All data, however, were evaluated for Level IV DQO, employing USEPA Region II validation criteria. The specifics for each parameter and associated QC are detailed below.
The sample identifications used in this report have been truncated for expediency. Unless otherwise indicated, all sample IDs are suffixed with -01.

## PRESERVATION:
The chains of custody indicated that the aqueous samples were preserved. The lab performed a check of the pH upon receipt, but did not provide documentation of the actual pH. Contact with the lab confirmed that all pH values were <2. No action was taken.

## HOLDING TIMES:
All samples were prepped and analyzed within specified holding times.

## MATRIX SPIKES:
The soil spike failed recovery criteria, but no action was required since the sample concentration was greater than 4 times the amount of spike added.
The aqueous spike was acceptable.

## LAB DUPLICATES:
The % solids reported for the sample and lab duplicate varied by more than 1 %. Therefore, the reviewer converted the sample results to wet weight and recalculated the RPD, which met criteria.
The aqueous duplicate was acceptable.

## FIELD DUPLICATE:
The results of the field duplicate were acceptable.

## LAB CONTROL SAMPLE (LCS):
The lab attempted to analyze a LCS, but no certified stock was available containing tungsten. The LCS that was analyzed did not contain any tungsten, so the results were not reported. No action was taken based on this criteria.

**SERIAL DILUTION:**
No serial dilution was performed. The following soil data were qualified as estimated (J) because the sample result exceeded 10 times the quantitation limit.

SS11-02, SS13, SS14, SS15, SS01, SS02, SS03, SS04, SS05-01D

No action was taken to the aqueous data since a serial dilution is not required to be performed on a field blank.

**BLANK CONTAMINATION:**
No qualifications were required.

**INSTRUMENT CALIBRATION:**
A CRI standard was not analyzed for W. No action was taken to the data since there was no specified CRDL.

**INTERFERENCE CHECK SAMPLE (ICS):**
An ICS was not performed. No interference was expected from the usual elements since the mass of interest for W is so high. No action was taken.

**GENERAL COMMENTS:**

Sample results were adjusted by the reviewer to correct for premature rounding performed by the laboratory.

The lab did not perform an IDL study or perform a linear range analysis. All samples were diluted to fall within the calibration range established by the initial calibration.

A from was not provided which summarized the results for the calibration blanks.

The client identifications for samples 9504608-08A and 09A required correction on the cross-reference supplied by the North Carolina lab.

The reported results for the soil spike required correction by the reviewer.

# TELEPHONE RECORD LOG

Date of Call: 6/21/95

Laboratory Name: IEA

Lab Contact: Leanne

Client: Foster Wheeler Envn.

Client Contact: C. Minch

Call Initiated By: ____ Laboratory x Client

In reference to data for the following sample number(s):

Captain's Cove ICP-MS data for Tungsten

Summary of Questions/Issues Discussed:

1. A CLP package format was requested. On the IEA COC, it was indicated that analyses were to be performed per ILMO3.0 (CLP) protocol. Regardless of the method utilized, all of the usual QC should have been run. Please submit the following raw data and/or summary form.
   1) Percent solids determinations. Were sample results reported on a dry weight basis?
   2) tuning solution analysis.
   3) CCB summary of results.
   4) LCSS summary of results.
   5) IDL with date of last determination.
   6) linear ranges.
2. Please submit a cross-reference of sample IDs with IEANC.
3. Why were prep blanks diluted?
4. In the method, the final volume for soil preparations is 50 ml, but the runlog indicates 100ml. Was this taken into account during quantification?

Cecelia N. Minch
Signature

6/21/95
Date

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5. I cannot reproduce the reported results. Please supply a sample calculation for each matrix. Were results corrected for any interferences or blank subtracted? Include all necessary information to reproduce all values.

6. Why wasn't a serial dilution, interference check sample or CRI standard analyzed? They are CLP protocol for metals.

7. The wrong units were used for all aqueous data. Please resubmit.

# TELEPHONE CALLS

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| | |
|---|---|
| 6/21 | IEANJ - Leanne: Briefly discuss items on faxed phone log. |
| 6/22 | IEANJ - Leanne: Informed me that requests were forwarded to IEANC and that she will be out of the office on 6/23. |
| 6/23 | IEANJ: Mike left a message that resubs will be delayed. |
| 6/26 | IEANJ: Leanne called to say that the resubs should be faxed to her in the afternoon and fedex to me for 6/27 AM. |
| 6/27 | IEANJ: Leanne called to say that the resubs are incomplete. Do I want a messenger to delivery a partial resub or wait for complete delivery on 6/28? I will wait for complete set. |
| 6/28 | IEANC: Message from G. Folk. An attempt to return the call was made at 5:01, but switchboard was off. |
| 6/29 | IEANC: Spoke with Gary regarding the unresolved questions. He will convey my concerns to the inorganic manager and get back to me in PM. No return call. |
| 6/30 | IEANC: Gary was unable to effectively explain the response to the dilution issues. I asked to speak with the IO manager D. Stogner. Spoke at length with Don regarding the prep and analysis. He will submit a brief explanation of the procedure and IDL determination. |
| 7/1 | IEANC: Spoke with don regarding the missing LCSS. He explained that no certified stock was available. Furthermore, the LCSS run appeared not to contain any W. |
| 7/1 | IEANJ: Spoke with Leanne to confirm that the pH was checked for the aqueous samples. |

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**Memo**

To: Cecelia Minch

From: Donald Stogner DCS

Subject: Tungsten by Method 200.8

Date: June 30, 1995

Please find listed below information to clarify how IEA performs 200.8 and information pertaining to your tungsten analysis specifically. Additionally I have included a copy of the dry weight log to aid in your calculations. If any questions are not answered here please do not hesitate to call.

IEA-NC performs 200.8 for soils by digesting one gram of sample using ultrex II grade acids following the steps listed in the 4.4 version of 200.8 from publication PB91-231498 section 11.2.2. After the digestion is complete IEA takes the sample to 100 ml and allows it to settle overnight. The method states to dilute the sample five fold prior to analysis. IEA performs this step immediately before analysis by pipetting 2 ml to 10 ml and adding internal standards. Should any reanalysis be required IEA repeats the dilution step from the one hundred ml final digested at either the required five fold dilution or higher. If the internal standards are outside the method specified range the lab dilutes the sample two fold from the original analysis and repeats this step until the internal standards meet the required method criteria. All dilutions on the runlog are listed from the one hundred ml digested. The sample would be originally listed as a 5X. A sample diluted one ml to one liter due to high analyte would be listed as a 1000X. The result would therefore be the dilution factor listed on the runlog times the final volume of one hundred ml times the instrument result divide by the dry weight and the weight. The instrument result in ug/l, final volume units would be in liters, the weight in grams, and the dry weight expressed as a fraction. This yields ug/g which is equivalent to mg/kg.

The waters are digested 100 ml initial volume to 50 ml final volume. The sample is diluted 2.5 fold per the method just prior to analysis. The dilution listed on the runlog is the dilution made from the 50 ml digestate. The result would be the instrument result times the final volume times the dilution factor divided by the initial volume. The result in ug/l is converted to mg/l and reported. All the digestates are left undiluted until analysis to make them as stable as possible. The dilution prior to analysis is specified in the method to reduce damage to the nickel cones.

Method 200.8 does not specify that a CRI, serial dilution, or Interference check be run. Iron, aluminum, calcium, magnesium do not interfere with mass spectroscopy since these masses are at 56 and 57, 27, 40 and 42, and 24 mass units. The only analyte in the method near these masses is manganese at 55 amu. Tungsten is at masses 182 and 184 and only has a small interference from osmium at 182. Both masses were monitored and agreed very well. Had an interference been observed mass 184 would have been used. Either mass may be used for these samples as no osmium appeared to be present.

IEA did not perform an idl study for tungsten. A five ug/l ICV was used and recovered very well with low RSD and a SD of 0.016085. From this data the lab reported a PQL of 1 ug/l. Since no linear range study was performed all samples were diluted below the calibration standard of 100 ug/l. CCVs were run at midrange of 50 ug/l.

All samples for this project were stored in the dark since tungsten is light sensitive to insure the stability of the digestates.

Donald Stogner

Donald Stogner
Inorganics Lab Manager

IEA
An Aquarion Company

628 Route 10
Whippany, New Jersey 07981

Phone 201·428·8181
Fax 201·428·5222

Ref. 2
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RECEIVED
JUN 2 1995
E. AGUADO

# CLP DATA PACKAGE

SAMPLING DATE APRIL 20, 1995

IEA JOB NO: 20950-51723B-REVISED

VOLUME I OF I

PREPARED BY:

INDUSTRIAL ENVIRONMENTAL ANALYSTS (IEA)

(CERTIFICATION NUMBER 14530)

FOR

FOSTER WHEELER ENVIRONMENTAL CORPORATION

PROJECT: CCP

 Ref. 27
1 of 39

PROJECT: 1254-204 BATCH: 9504608 METHOD: EPA 200.8

Samples: Twelve (12) Soils and Two (2) Water Samples

The samples were received at Industrial and Environmental Analysts, Inc. (IEA) on April 24, 1995. Each sample was assigned a 9-character "IEA" lab identification number (lab ID) and an abbreviated client ID which is referenced on the IEA Assigned Number Index. All analyses are performed in accordance with EPA approved methodologies and meet the requirements of the IEA Quality Assurance Program. Please see the enclosed data package for your results and Chain of Custody documentation.

The pH of all samples for Metals analysis was less than two (2) at the time of sample preparation.

Any nonconformances associated with the analysis of the samples in this project are as follows:

The quantitation limits for samples 9504608-01 through 05 and 09 through 14 were elevated due to a dilution prior to analysis. The samples were diluted due to high levels of Tungsten.

I certify that this data package is in compliance with the procedures and methods defined for this project, both technically and for completeness, for other than the conditions detailed above. Release of the data contained in this hardcopy data package and in the computer-readable data (if applicable) as submitted has been authorized by the laboratory manager or his designee, as verified by the following signature.

Wallace L. McAnulty

Wallace L. McAnulty
Inorganic Technical Data Reviewer
IEA, Inc.
May 30, 1995

IEA, Inc Doc# RPP00900.NC

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0C0003

# CHAIN OF CUSTODY DOCUMENTATION

51723

# EBASCO SERVICES INCORPORATED
# CHAIN OF CUSTODY RECORD

PROJECT: CC.

SAMPLERS: (Signature)

| | SAMPLE NUMBER | DATE | TIME | COMP. | GRAB | NO. CONTAINERS | TCL VOA | TCL BNA | TCL PEST./PCB | TAL METALS | CYANIDE | Tungsten | | | REMARKS OR SAMPLE LOCATION | ICED | SPECIFY CHEMICALS ADDED AND FINAL pH IF KNOWN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CC-SS12-01 | 4/20/95 | 12:55 | | X | | | | | X | X | X | | | 9.26 uR/hr. | Y | |
| 2 | CC-SS13-01 | 4/20/95 | 9:30 | | X | | | | | X | X | X | | | 51.85 uR/hr. | Y | |
| 3 | CC-SS14-01 | 4/20/95 | 13:40 | | X | | | | | X | X | X | | | 14.8 uR/hr. | Y | |
| 4 | CC-SS15-01 | 4/20/95 | 13:40 | | X | | | | | X | X | X | | | 14.8 uR/hr | Y | |
| 5 | CC-SS-11-02 | 4/20/95 | 15:30 | | X | | | | | X | X | X | | | 3.1 uR/hr | Y | |
| 6 | CC-SS11-03 | 4/20/95 | 15:30 | | X | | | | | X | X | X | | | 3.1 uR/hr | Y | |
| 7 | CC-FB02-01 | 4/20/95 | 14:20 | | X | | | | | X | X | X | | | Field Blank | Y | $HNO_3$ metals tungsten / NaOH CN- |
| 8 | CC-FB01-01 | 4/20/95 | 15:00 | | X | | | | | X | X | X | | | Field Blank | Y | |

| Relinquished by: (Signature) | | Date / Time | Received by: (Signature) | Relinquished by: (Signature) | | Date / Time | Shipped via: |
|---|---|---|---|---|---|---|---|
| [signature] | 1 | 4/20/95 | Fed Ex | | 4 | | |
| Relinquished by: (Signature) | 2 | Date / Time | Received by: (Signature) | Received for Laboratory by: (Signature) [signature] | | 4/21/95 830 | Shipped Ticket No. |
| Relinquished by: (Signature) | 3 | Date / Time | Received by: (Signature) | Remarks: Shipped via Fed Ex Airbill # 485253430 | | | |

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Ref. 27

51723

# EBASCO SERVICES INCORPORATED
## CHAIN OF CUSTODY RECORD

PROJECT: C.C.

SAMPLERS: (Signature) [signatures] Patter

| | SAMPLE NUMBER | DATE | TIME | COMP. | GRAB | NO. CONTAINERS | TCL VOA | TCL BNA | TCL PEST./PCB | TAL METALS | CYANIDE | Tungsten | | | REMARKS OR SAMPLE LOCATION | ICED | SPECIFY CHEMICALS ADDED AND FINAL pH IF KNOWN |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 9 | LT-SS01-01 | 4/20/95 | 8:15 | | X | | | | X | X | X | | | | 5.93 uR/hr. | X | |
| 10 | LT-SS02-01 | 4/20/95 | 8:35 | | X | | | | X | X | X | | | | 9.41 uR/hr. | X | |
| 11 | LT-SS03-01 | 4/20/95 | 9:37 | | X | | | | X | X | X | | | | 5.93 uR/hr. | X | |
| 12 | LT-SS04-01 | 4/20/95 | 9:54* | | X | | | | X | X | X | | | | 5.19 uR/hr. | X | |
| 13 | LT-SS05-01 | 4/20/95 | 9:07 | | X | | | | X | X | X | | | | 5.93 uR/hr. | X | |
| 14 | LT-SS05-01D | 4/20/95 | 9:07 | | X | | | | X | X | X | | | | 5.56 uR/hr. | X | |

*Per Mike Heffron's request on 4/27/95, Lab to designate this sample for MS/MSD /acp 4/27/95

| Relinquished by: (Signature) | | Date / Time | Received by: (Signature) | Relinquished by: (Signature) | | Date / Time | Shipped via: |
|---|---|---|---|---|---|---|---|
| [signature] | 1 | 4/20/95 | Fed Ex | | 4 | | |
| Relinquished by: (Signature) | 2 | Date / Time | Received by: (Signature) | Received for Laboratory by: (Signature) [signature] | | Date / Time 4/21/95 9:30 | Shipped Ticket No. |
| Relinquished by: (Signature) | 3 | Date / Time | Received by: (Signature) | Remarks: Shipped via Fed Ex Airbill # 4858534330 | | | |

102952

003005

N: 06113

IEA OF NEW JERSEY
628 Route 10 Whippany, N.J. 07981
(201) 428-8181

# CHAIN OF CUSTODY

FIELD BOOK: ____ Pg ____ of ____

(1) Client: IEA NJ
(2) Project Name/no.: 20550 51723
(3) Client Contact: L. Schorbach
(4) IEA Contact:
(5) TAT: 1wk, 2wk, 3wk, *, OTHER 5/2/95
(6) Proj. Type: NJPDES, NPDES, ISRA, CLP, CERCLA, RCRA, UST, ACO, MOA, OTHER
(7) Protocol: 3/90 CLP, SW846, EPA 600, DW, OTHER
(8) Reporting Type: NJ Regulatory Format, NJ Reduced Format, CLP, Level II, Level I (Data Summaries), Other

(14) Bill To
PO#

(15) ANALYSIS REQUIRED

For Lab Use Only: Job No. / Quote No. / # of Coolers / Cooler Temp. (s) / Custody Seal # (s) / Date Due

PM NON-CONFORMANCE: Preserved / Temp. / Container / Volume / Broken / Initials / Holding Time / Other

Logged By:

| (9) Client ID (10 CHAR) | (10) Date | (11) Time | (12) Mtx | (13) # OF CONTAINERS | Tungsten ICP/MS | DESCRIPTION |
|---|---|---|---|---|---|---|
| CCSS12-01 | 4/20 | 1255 | SO | 1 | x | 51723-001 |
| CCSS13-01 | | 930 | | 1 | x | 002 |
| CCSS14-01 | | 1340 | | 1 | x | 003 |
| CCSS15-01 | | 1340 | | 1 | x | 004 |
| CCSS11-02 | | 1530 | | 1 | x | 005 |
| CCSS11-03 | | 1530 | | 1 | x | 006 |
| CCFD02-01 | | 1410 | AQ | 1 | x | 007 |
| CCFB01-01 | | 1500 | AQ | 1 | x | 008 |
| LTSS01-01 | | 815 | SO | 1 | x | 009 |
| LTSS02-01 | | 835 | | 1 | x | 010 |
| LTSS03-01 | | 937 | | 1 | x | 011 |
| LTSS04-01 | | 954 | | 1 | x | 012 |
| LTSS05-01 | | 907 | | 1 | x | 013 |
| LTSS05-010 | | 907 | | 1 | x | 014 |

(16) COMMENTS: (Please include hazards on site.)
RUN BY x ICP/MS
CLP PROTOCOL ILM3.0
IEA# 1259-204
3°C

(17)

| | Print Name and Company | Signature | Custody Seal # (s) | Date/Time |
|---|---|---|---|---|
| Sampled By: | | | | / |
| Received By: | | | | / |
| Relinquished By: | John Proefrock IEA | [signature] | | 4/21/95 / 1300 |
| Received By: | D. McCormick IEA | D. McCormick | | 4-24-95 / 0900 |
| Relinquished By: | | | | / |
| Received By: | | | | / |

Mtx = Matrix of Sample. (AI=Air, AQ=Aqueous, LE=Leachate, ML=Misc Liquid, MS=Misc Solids, OIL, SE=Sediment, SL=Sludge, SO=Soil)

* Standard TAT.

(Copies: White and yellow copies should accompany samples to IEA. The pink copy should be retained by the client.) See reverse for directions.

102953

0035

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000007

# IEA OF NEW JERSEY
## SAMPLE CONTROL CHRONICLE

Sampling Date: 4/18/95 Job #: 51723

Receipt Date: 4/21/95 Signature: [illegible]

Custody Seal: Present/Absent
Intact/Not Intact Cooler Temp: 4

Chain of Custody: Present/Absent

Sample Tags: Present/ Absent Preservative Ck: ✓

Shipping Bill: Present/ Absent Airbill #:

Comments:

### Subcontracting

| Parameter | Sample ID | Parameter | Sample ID |
|---|---|---|---|
| MBAS | | TKN | |
| AMMONIA | | O-PHOSPHATE | |
| COD | | SULFIDE | |
| SULFATE | | COLIFORM | |
| NITRATE | | ALKALINITY | |
| BOD | | TURBIDITY | |
| NITRATE | | COLOR | |
| NITRITE | | TOC | |
| RADIUM | | TOX | |
| THORIUM | | OTHER W | 1-14 |
| URANIUM | | OTHER | |

Subcontract Lab: [illegible] Date:

Signature: [illegible]

### Sample Prep

Sample #

Compositing:

Percent Solids: 1-5, 8-14

pH Performed:

Signature: [illegible] Date: 4-27-95

Form# SMF00601.NJ

Page ____ OF 98
IEA Logbook# SM6

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CC0008

# TUNGSTEN

102955

Industrial & Environmental Analysts, Inc. (IEA)

IEA Project #: 1254-204
IEA Sample #: 9504608-01
Client Name: IEA - New Jersey
Client Proj. I.D.: 20950-51723
Sample I.D.: CCSS12-01

Matrix: Soil
Date Received: 04/24/95
Date Sampled: 04/20/95

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| -Tungsten | EPA 200.8 | 5.7 mg/kg* | 51 mg/kg | 05/08/95 | 05/24/95 | FW |

Comments:

Quantitation limit elevated due to sample dilution prior to analysis.
Sample diluted due to high concentration of interferent.

FORM RESP3 Rev. 030994

Industrial & Environmental Analysts, Inc. (IEA)

IEA Project #: 1254-204
IEA Sample #: 9504608-02
Client Name: IEA - New Jersey
Client Proj. I.D.: 20950-51723
Sample I.D.: CCSS13-01

Matrix: Soil
Date Received: 04/24/95
Date Sampled: 04/20/95

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| -Tungsten | EPA 200.8 | 59 mg/kg* | ~~1200~~ mg/kg 1210 J | 05/08/95 | 05/24/95 | FW |

Comments:

Quantitation limit elevated due to sample dilution prior to analysis.
Sample diluted due to high concentration of interferent.

FORM RESP3 Rev. 030994

Ref. 2

000011

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Industrial & Environmental Analysts, Inc. (IEA)

IEA Project #: 1254-204
IEA Sample #: 9504608-03
Client Name: IEA - New Jersey
Client Proj. I.D.: 20950-51723
Sample I.D.: CCSS14-01

80%

Matrix: Soil
Date Received: 04/24/95
Date Sampled: 04/20/95

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| r-Tungsten | EPA 200.8 | 120 mg/kg* | 3200 mg/kg | 05/08/95 | 05/24/95 | FW |

Comments:

Quantitation limit elevated due to sample dilution prior to analysis.
Sample diluted due to high concentration of interferent.

FORM RESP3 Rev. 030994

Industrial & Environmental Analysts, Inc. (IEA)

IEA Project #: 1254-204
IEA Sample #: 9504608-04
Client Name: IEA - New Jersey
Client Proj. I.D.: 20950-51723
Sample I.D.: CCSS15-01
Matrix: Soil
Date Received: 04/24/95
Date Sampled: 04/20/95

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| ?-Tungsten | EPA 200.8 | 240 mg/kg* | 3800 mg/kg J | 05/08/95 | 05/24/95 | FW |

Comments:

Quantitation limit elevated due to sample dilution prior to analysis.
Sample diluted due to high concentration of interferent.

FORM RESP3 Rev. 030994

Industrial & Environmental Analysts, Inc. (IEA)

IEA Project #: 1254-204
IEA Sample #: 9504608-05
Client Name: IEA - New Jersey
Client Proj. I.D.: 20950-51723
Sample I.D.: CCSS11-02

Matrix: Soil
Date Received: 04/24/95
Date Sampled: 04/20/95

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| Tungsten | EPA 200.8 | 7.7 mg/kg* | 180 mg/kg | 05/08/95 | 05/24/95 | FW |

Comments:

* Quantitation limit elevated due to sample dilution prior to analysis.
  Sample diluted due to high concentration of interferent.

FORM RESP3 Rev. 030994

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000014

Industrial & Environmental Analysts, Inc. (IEA)

IEA Project #: 1254-204
IEA Sample #: 9504608-06
Client Name: IEA - New Jersey
Client Proj. I.D.: 20950-51723
Sample I.D.: CCSS11-03

Matrix: Soil
Date Received: 04/24/95
Date Sampled: 04/20/95

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| -Tungsten | EPA 200.8 | 0.55 mg/kg | 1.4 mg/kg | 05/08/95 | 05/24/95 | FW |

Comments:

FORM RESP3 Rev. 030994

Del.27
24 of 39
0C0015

Industrial & Environmental Analysts, Inc. (IEA)

IEA Project #: 1254-204
IEA Sample #: 9504608-07
Client Name: IEA - New Jersey
Client Proj. I.D.: 20950-51723
Sample I.D.: CCFB02-01

Matrix: Water
Date Received: 04/24/95
Date Sampled: 04/20/95

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| -Tungsten | EPA 200.8 | 0.001 mg/L | BQL | 05/08/95 | 05/24/95 | FW |

Comments:

FORM RESP3 Rev. 030994

Industrial & Environmental Analysts, Inc. (IEA)

IEA Project #: 1254-204
IEA Sample #: 9504608-08
Client Name: IEA - New Jersey
Client Proj. I.D.: 20950-51723
Sample I.D.: LTFB0101

Matrix: Water
Date Received: 04/24/95
Date Sampled: 04/20/95

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| T-Tungsten | EPA 200.8 | 0.001 mg/L | BQL | 05/08/95 | 05/24/95 | FW |

Comments:

FORM RESP3 Rev. 030994

Industrial & Environmental Analysts, Inc. (IEA)

.EA Project #: 1254-204
IEA Sample #: 9504608-09
lient Name: IEA - New Jersey
lient Proj. I.D.: 20950-51723
Sample I.D.: LT-SS01-01

Matrix: Soil
Date Received: 04/24/95
Date Sampled: 04/20/95

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| -Tungsten | EPA 200.8 | 260 mg/kg* | 3000 mg/kg J | 05/08/95 | 05/24/95 | FW |

.omments:

uantitation limit elevated due to sample dilution prior to analysis.
ample diluted due to high concentration of interferent.

FORM RESP3 Rev. 030994

Industrial & Environmental Analysts, Inc. (IEA)

IEA Project #: 1254-204
IEA Sample #: 9504608-10
Client Name: IEA - New Jersey
Client Proj. I.D.: 20950-51723
Sample I.D.: LT-SS02-01

Matrix: Soil
Date Received: 04/24/95
Date Sampled: 04/20/95

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| Tungsten | EPA 200.8 | 1200 mg/kg* | ~~16000~~ mg/kg<br>16200 J | 05/08/95 | 05/24/95 | FW |

Comments:

* Quantitation limit elevated due to sample dilution prior to analysis. Sample diluted due to high concentration of interferent.

FORM RESP3 Rev. 030994

Rv.27
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CC0019

Industrial & Environmental Analysts, Inc. (IEA)

IEA Project #: 1254-204
IEA Sample #: 9504608-11
Client Name: IEA - New Jersey
Client Proj. I.D.: 20950-51723
Sample I.D.: LT-SS03-01

Matrix: Soil
Date Received: 04/24/95
Date Sampled: 04/20/95

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| -Tungsten | EPA 200.8 | 120 mg/kg* | ~~1200~~ 1100 mg/kg J | 05/08/95 | 05/24/95 | FW |

Comments:

Quantitation limit elevated due to sample dilution prior to analysis.
Sample diluted due to high concentration of interferent.

FORM RESP3 Rev. 030994

102966

REF. 27
29 OF 39

Industrial & Environmental Analysts, Inc. (IEA)

A Project #: 1254-204 (Revision)
EA Sample #: 9504608-12 Matrix: Soil
lient Name: IEA - New Jersey Date Received: 04/24/95
ient Proj. I.D.: 20958-51723 Date Sampled: 04/20/95
mple I.D.: LT-SS04-01

| arameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| Tungsten | EPA 200.8 | 250 mg/kg* | ~~4500~~ mg/kg 4540 J | 05/08/95 | 05/24/95 | FW |

mments:

Quantitation limit elevated due to sample dilution prior to analysis.
ample diluted due to high concentration of interferent.

FORM RESP3 Rev. 030994

102967

Industrial & Environmental Analysts, Inc. (IEA)

| | |
|---|---|
| A Project #: | 1254-204 |
| EA Sample #: | 9504608-13 |
| ient Name: | IEA - New Jersey |
| ient Proj. I.D.: | 20950-51723 |
| ample I.D.: | LT-SS05-01 |
| Matrix: | Soil |
| Date Received: | 04/24/95 |
| Date Sampled: | 04/20/95 |

| arameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| Tungsten | EPA 200.8 | 140 mg/kg* | 1200 mg/kg | 05/08/95 | 05/24/95 | FW |

Comments:

* uantitation limit elevated due to sample dilution prior to analysis. ample diluted due to high concentration of interferent.

FORM RESP3 Rev. 030994

Industrial & Environmental Analysts, Inc. (IEA)

.EA Project #: 1254-204
IEA Sample #: 9504608-14
lient Name: IEA - New Jersey
lient Proj. I.D.:20950-51723
Sample I.D.: LT-SS05-01D

Matrix: Soil
Date Received: 04/24/95
Date Sampled: 04/20/95

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| -Tungsten | EPA 200.8 | 140 mg/kg* | 1400 mg/kg | 05/08/95 | 05/24/95 | FW |

.omments:

Quantitation limit elevated due to sample dilution prior to analysis.
Sample diluted due to high concentration of interferent.

FORM RESP3 Rev. 030994

Industrial & Environmental Analysts, Inc. (IEA)

ΣA Project #: 1254-204
IEA Sample #: 9504608
Client Name: IEA - New Jersey
Client Proj. I.D.: 20950-51723
Sample I.D.: QC Blank
Matrix: Solid
Date Received: N/A
Date Sampled: N/A

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| --Tungsten | EPA 200.8 | 0.50 mg/kg | BQL | 05/08/95 | 05/24/95 | FW |

mments:

Corresponding Samples: 9504608-01 through 06 and 09 through 14

FORM RESP3 Rev. 030994

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0C0024

Industrial & Environmental Analysts, Inc. (IEA)

..A Project #: 1254-204
IEA Sample #: 9504608
ient Name: IEA - New Jersey
ient Proj. I.D.: 20950-51723
Sample I.D.: QC Blank

Matrix: Water
Date Received: N/A
Date Sampled: N/A

| Parameter | Method | Quantitation Limits | Results | Date Prepared | Date Analyzed | Analyst |
|---|---|---|---|---|---|---|
| Tungsten | EPA 200.8 | 0.001 mg/L | BQL | 05/08/95 | 05/24/95 | FW |

Comments:

: rresponding Samples: 9504608-07 and 08

FORM RESP3 Rev. 030994

Industrial & Environmental Analysts, Inc. (IEA)

## INORGANIC QC SUMMARY
## DUPLICATE ANALYSIS

IEA Project No.: 1254-204
IEA Sample No.: 9504608
Matrix: Soil

| IEA Reference No. | Test Parameter | Method | DUPLICATE RESULTS Sample (mg/kg) | Duplicate (mg/kg) | RPD (%) | Date Analyzed |
|---|---|---|---|---|---|---|
| 9504608-12 | T-Tungsten | EPA 200.8 | ~~4400~~ | ~~3800~~ | 15 | 05/24/95 |
| | | dry | 4542 | 3762 | 17 | |
| | | wet | [illegible] | [illegible] | 17 | |

$$RPD = \frac{S-D}{(S+D)/2} \times 100$$

Control Limits: +/- 20%

Comments:

Corresponding Samples: 9504608-01 through 06 and 09 through 14

FORM IQCSUM Rev 103194

Industrial & Environmental Analysts, Inc. (IEA)

INORGANIC QC SUMMARY
DUPLICATE ANALYSIS

IEA Project No.:1254-204
IEA Sample No.: 9504608
Matrix: Water

| IEA Reference No. | Test Parameter | Method | DUPLICATE RESULTS Sample (mg/L) | Duplicate (mg/L) | RPD (%) | Date Analyzed |
|---|---|---|---|---|---|---|
| 9504608-07 | T-Tungsten | EPA 200.8 | <0.001 | <0.001 | 0 | 05/24/95 |

$$RPD = \frac{S-D}{(S+D)/2} \times 100$$

Control Limits: +/- 20%

Comments:

Corresponding Samples: 9504608-07 and 08

FORM IQCSUM Rev 103194

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CC0027

Industrial & Environmental Analysts, Inc. (IEA)

**INORGANIC QC SUMMARY**
**SPIKE RESULTS**

IEA Project No.: 1254-204
IEA Sample No.: 9504608
Matrix: Soil

| IEA Reference No. | Test Parameter | Method | SPIKE RESULTS (mg/kg) SA | SR | SSR | %R | Analysis Date |
|---|---|---|---|---|---|---|---|
| 504608-12 | T-Tungsten | EPA 200.8 | 12 | ~~4400~~ 4512 | ~~3600~~ [illegible] | @ [illegible] | 05/24/95 |

%R = (SSR - SR)/ (SA) * 100          Control Limits: 75 - 125%

Comments:

@Percent recovery not calculated due to the sample concentration being greater than four times the concentration of the spiking solution.

Corresponding Samples: 9504608-01 through 06 and 09 through 14

FORM IQCSPK Rev 103194

102974

Industrial & Environmental Analysts, Inc. (IEA)

INORGANIC QC SUMMARY
SPIKE RESULTS

IEA Project No.: 1254-204
IEA Sample No.: 9504608
Matrix: Water

| IEA Reference No. | Test Parameter | Method | SPIKE RESULTS (mg/L) SA | SR | SSR | %R | Analysis Date |
|---|---|---|---|---|---|---|---|
| 9504608-07 | T-Tungsten | EPA 200.8 | 0.10 | <0.001 | 0.10 | ~~100~~ 103 | 05/24/95 |

%R = (SSR - SR)/ (SA) * 100

Control Limits: 75 - 125%

Comments:

Corresponding Samples: 9504608-07 and 08

FORM IQCSPK Rev 103194

Industrial & Environmental Analysts, Inc. (IEA)

INORGANIC QC SUMMARY
Laboratory Control Sample

IEA Project No.: 1254-204
IEA Sample No.: 9504608

| Parameter | Method | True Value (mg/L) | Found | % Recovery | Analysis Date |
|---|---|---|---|---|---|
| T-Tungsten | EPA 200.8 | 0.100 | 0.104 | 104 | 05/24/95 |

mg/L

Comments:

Control limit is 80% - 120% for all metals.

FORM QCLCSW Rev.030994

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CC0030

Industrial & Environmental Analysts, Inc. (IEA)

CALIBRATION VERIFICATION

IEA Project No.: 1254-204
IEA Sample No.: 9504608

| Parameter | ICV Value (mg/L) | ICV Found (mg/L) | % Recovery | CCV Value (mg/L) | CCV Start (mg/L) | % Recovery | CCV End (mg/L) | % Recovery | Analysis Date |
|---|---|---|---|---|---|---|---|---|---|
| -Tungsten | 0.005 | 0.005 | 100 | ~~0.0050~~ 0.0[illegible] | ~~0.0050~~ [illegible] | ~~100~~ 99.[illegible] | ~~0.051~~ [illegible] | ~~102~~ 97.4 | 05/24/95 |

CCV

Comments:

Control limit is 90% - 110% for all metals, except Hg which is 80% - 120%.
Control limit is 85% - 115% for all wet chemistry parameters.

M CALVER REV 030994

102977

REFERENCE NO. 28

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# INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
# CITY OF GLEN COVE
# NASSAU COUNTY, NEW YORK

VOLUME I
(WITH APPENDIX A)

NASSAU COUNTY
DEPARTMENT OF PUBLIC WORKS
Commissioner Ludwig C. Hasl, P.E.

NASSAU COUNTY
DEPARTMENT OF HEALTH
Commissioner John B. Branche, M.D., F.A.A.P.

County Executive
Thomas S. Gulotta

JUNE 1990

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2 of 119

# TABLE OF CONTENTS

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# TABLE OF FIGURES

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# TABLE OF TABLES

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## Executive Summary

Through numerous regulatory and operational programs Nassau County has demonstrated a deep commitment to the protection of our water resources. One important area of protection is the identification of contaminated aquifer segments which pose a threat to the public water supply. The County Executive, cognizant of the importance of identifying sources of groundwater contamination, authorized in January 1988 the County Departments of Health and Public Works to jointly investigate potential contaminated aquifer segments and prepare technical reports identifying areas of contamination that require remedial action. The first product of this joint program and the subject of this report was the investigation of groundwater contamination by volatile organic chemicals (VOC's) associated with the Sea Cliff Avenue industrial zone in the City of Glen Cove.

The need for a more detailed study within the City of Glen Cove was based upon the detection of significant levels of volatile organic chemicals in existing monitoring, industrial, and public supply wells. This contamination caused the 1977 closure of three public supply wells owned by the City of Glen Cove at the Carney Street well field due to VOC levels exceeding New York State Department of Health drinking water guidelines. Additionally, this contamination could potentially affect other City of Glen Cove and Sea Cliff Water Company public supply wells.

A two-phased study approach was utilized to identify the areal and vertical extent of the groundwater contamination. Phase One involved the review of all existing water quality, hydrogeologic, well construction, and industrial chemical survey data. Thirteen (13) Phase One groundwater monitoring wells were installed based upon the results of this review. Phase Two involved the assessment of the Phase One water quality and hydrogeologic data, and included the installation of seven (7) additional monitoring wells to further define the three-dimensional

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## APPENDICES

diffusion, in conjunction with the natural groundwater flow and contaminant advection, has caused the contamination to be spread throughout the aquifer at the source area and in the downgradient direction. These pumpage and diffusion impacts must be studied in more detail before any remedial measures can be accurately assessed.

It is recommended that this study be provided to the New York State Department of Environmental Conservation for review and regulatory action. In addition, site specific investigative work must be performed at the present or former industrial locations where VOC's were or are stored to better define contaminant source areas. These future studies also must address potential impacts from the Sea Cliff Avenue industrial zone contaminant plume on receptors such as public supply wells 9334 (City of Glen Cove, Kelly Street) and 7857 (Sea Cliff Water Company).

Ref. 28
9.F(19

extent of the groundwater plume as well as potential source areas.

The industrial chemical profile noted that primary contaminants detected in the groundwater at the study area are common to those reported in the industrial chemical survey and predominantly include tetrachloroethylene, trichloroethylene, and 1,1,1-trichloroethane. Tetrachloroethylene was the VOC compound detected at the highest concentration of 3,700 micrograms/Liter (ug/L) followed by trichloroethylene at 500 ug/L. Lower levels of 1,1,1-trichloroethane were also detected as well as other chlorinated compounds, most notably cis-1,2-dichloroethylene, 1,1-dichloroethane and vinyl chloride, which represent potential breakdown compounds from tetrachlorethylene and trichloroethylene.

The findings of this investigation have identified a groundwater contamination plume of VOC's emanating from the Sea Cliff Avenue industrial zone extending from the water table to the base of the upper glacial aquifer. The water table portion of the plume bifurcates away from the source area (Sea Cliff Avenue industrial zone) moving westerly and northerly and has traveled a minimum of 2,400 ft. in each direction. The highest level of total VOC contamination in this plume ranges up to 5,500 ug/L immediately to the north of the Sea Cliff Avenue industrial zone at the Carney Street well field.

The deep upper glacial portion of the plume extends to the base of the upper glacial aquifer at the source area and at the furthest downgradient well. The plume has moved northwesterly with the groundwater flow a minimum distance of 2,400 ft. from the source area. Total VOC levels range from 698 ug/L in the vicinity of the source area to 79 ug/L at the downgradient fringe of the plume.

It should be noted that localized industrial pumpage at the Sea Cliff Avenue industrial zone, has caused groundwater contaminants to move vertically downward into the deep industrial supply wells where it is subsequently reintroduced back into the aquifer through diffusion wells set at various depths. This pumpage and

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## 1.0 INTRODUCTION

### 1.1 Background

In January of 1988, the Nassau County Department of Health (NCDH) entered into a cooperative agreement with the Nassau County Department of Public Works (NCDPW) to perform detailed investigations of groundwater contamination in the City of Glen Cove and the Village of Lake Success, as recommended in a prior NCDH report identifying several areas in need of further water quality study. Further investigation in Lake Success was subsequently postponed pending the results of a current study in the area being performed by consultants to the Unisys Corporation. The investigation of groundwater contamination by volatile organic chemicals (VOC's) associated with the Sea Cliff Avenue industrial zone in the City of Glen Cove is the subject of this report.

The need for a more detailed study within the City of Glen Cove was based upon the detection of significant levels of volatile organic chemicals in existing monitoring, industrial, and public water supply wells. This contamination caused the 1977 closure of three public supply wells owned by the City of Glen Cove. These wells, located at the Carney Street well field were closed due to VOC levels exceeding New York State Department of Health drinking water guidelines. This contamination could potentially affect other City of Glen Cove and Sea Cliff Water Company public supply wells.

This investigation was jointly funded and administered by NCDH and NCDPW.

### 1.2 Purpose and Scope

The purpose of this study was to identify the areal and vertical extent of groundwater contamination by volatile organic chemicals at the Sea Cliff Avenue industrial zone in the City of Glen Cove by performing a subsurface investigation in the vicinity of the Carney Street well field. Based on the results of the investigation, potential sources of contamination are identified and

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recommendations are made regarding methods to manage the contaminated aquifer segment.

The scope of this investigation was comprised of the following tasks:

- Review of available data on the location, construction, and water quality of existing monitoring, industrial, and public supply wells in the study area.
- Research of existing reports, records, and data to determine regional hydrogeology.
- Review of NCDH records to determine the storage, use and disposal of industrial chemicals and chemical waste products by local industries.
- Investigation of the location of other potential sources of groundwater contamination in the area including landfills, chemical and petroleum spills.
- Analysis of existing data, development and implementation of a subsurface investigation of groundwater contamination.
- Development of specifications and locations for monitoring well installations to be completed by a well drilling firm under contract to NCDPW.
- Sampling of newly installed and existing wells to determine water quality.
- Development of water level and volatile organic chemical concentration contour maps.
- Evaluation of water quality, determine extent of contamination and evaluate possible source areas within the study area.
- Development of groundwater flow maps and geologic profiles to determine potential contaminant pathways.
- Report preparation on the investigation methodology and findings including recommendations for technical procedures regarding management of the

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contaminated aquifer segment.

## 1.3 Study Approach

A two-phased study approach was utilized to identify the areal and vertical extent of groundwater contamination at the Sea Cliff Avenue industrial zone in the City of Glen Cove.

Phase One involved the review of all existing water quality, hydrogeologic, well construction, industrial survey and other pertinent information. Thirteen (13) Phase One groundwater monitoring wells were installed around the Sea Cliff Avenue industrial zone based upon the results of this review. Phase Two involved the assessment of the Phase One water quality and hydrogeologic data, and included the installion of seven (7) additional Phase Two wells to further define the three-dimensional extent of the groundwater contamination plume as well as potential source areas.

## 1.4 Study Area

The study area designated for this investigation encompasses approximately three square miles of the northeast corner of the Town of Oyster Bay, Nassau County, New York, including the southern portion of the City of Glen Cove, the northern portion of the Village of Glen Head, and small portions of the Villages of Sea Cliff and Old Brookville (see Figure 1-1).This area was selected to encompass a one-mile radius surrounding the Carney Street well field and to provide a judicious base from which existing land use and water quality information could be collected for analysis.

Water service within the study area is supplied by public supply wells operated by the City of Glen Cove, the Jericho Water District, and the Sea Cliff Water Company. Public sanitary sewering has been provided within the City of Glen Cove since the 1920's, with most areas sewered by the 1950's. Areas outside of the City rely on individual septic systems for waste disposal.

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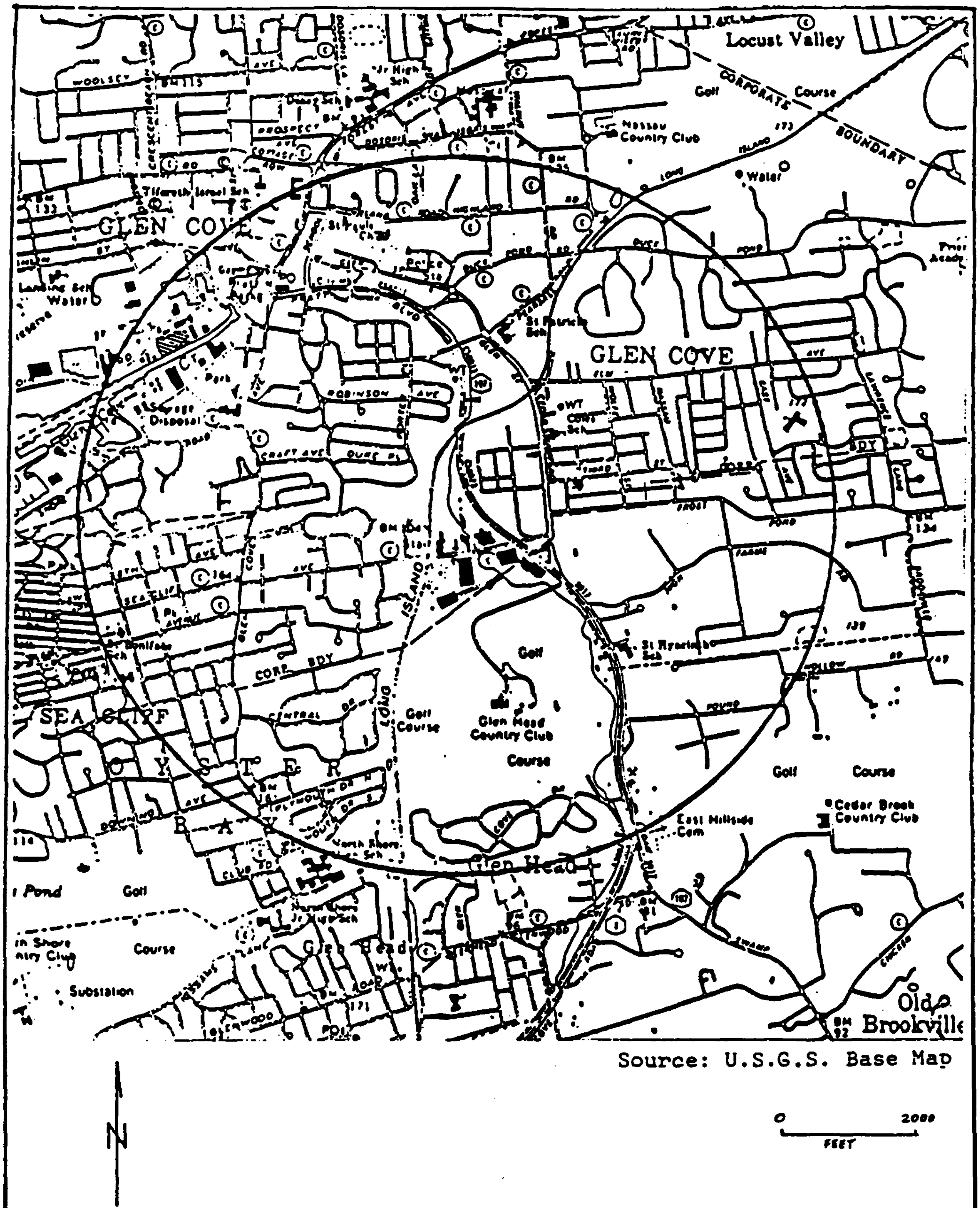


Figure 1-1 Glen Cove Site Location Map



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Stormwater runoff in the study area is collected by underground drainage pipes and structures for transport to recharge basins. Installation of this system began in the 1920's and has continued to date with additional drainage networks being installed as required for new developments, road improvements, or to correct existing problem areas. The project study area is served by seven (7) stormwater recharge basins. Discharge of stormwater from the Sea Cliff Avenue industrial area is to either Nassau County recharge basin #469 or to Glen Cove Creek, which runs directly through the area's center. Recharge basin #469 has accepted stormwater discharges since 1940 while the remaining basins in the area were installed between 1940 and 1952.

There are no active municipal or private landfills within the study area, however, a municipal landfill located at the northwestern extreme of the study area on Morris Avenue was operated by the City of Glen Cove until approximately 1970. This landfill accepted all types of refuse and trash, including incinerator ash and agricultural wastes. The landfill has been capped and is currently a recreational area.

The study area features a surface topography which has been formed by the process of glacial recession (see Figure 1-2). Prominent landforms include glacial kames (conical hills deposited in contact with ice), kettles (depressions) and valleys. A north-to-south valley runs through the heart of the study area, featuring elevations of approximately 66 ft. at the Glen Head Country Club, 54 ft. at the Sea Cliff Avenue industrial area and dropping northward to approximately 42 ft. at the arterial highway railroad overpass. Glen Cove Creek occupies this valley. A large kame rises to approximately 175 ft. above sea level (asl) at the Glen Head Country Club, with Glen Cove Creek to the east. Kamic topographic highs exist to the east and west of the Sea Cliff Avenue industrial zone, rising to approximately 180 and 170 ft. asl, respectively.

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Base Maps: U.S.G.S. Sea Cliff & Hicksville Quadrangles

N

Scale
1"= 2000 ft.

## Figure 1-2 Site Topography

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1.5 Regional Hydrogeology

The regional geologic formations of the northern part of the Town of Oyster Bay as described by Kilburn and Krulikas (USGS, 1987) are composed of unconsolidated glacial deposits of Pleistocene age, and coastal plain deposits of continental and marine origin of Cretaceous age. The unconsolidated deposits consist of gravel, sand, silt and clay underlain by bedrock of Lower Paleozoic and/or Precambrian age, which forms the base of the groundwater reservoir.

Figures 1-3 and 1-4 are regional geologic north-to-south and east-to-west cross-sections through the study area (see Figure 1-5 for cross section locations). The crystalline bedrock, generally consisting of schist and gneiss, features a gentle southeasterly dipping weathered surface. Overlying the bedrock is the Lloyd Sand member (Lloyd aquifer) of the Raritan Formation of Late Cretaceous age. This formation consists of discontinuous beds of gravel, sand, sandy clay, silt and clay and lies roughly parallel to the bedrock surface. The clay member of the Raritan Formation (Raritan Clay) overlies the Lloyd aquifer and consists of clay with varying amounts of silt and sand. The Raritan Clay confines groundwater in the underlying Lloyd aquifer.

The Matawan Group-Magothy Formation undifferentiated (Magothy aquifer) overlies the Raritan Clay. The Magothy Formation consists of discontinuous beds and lenses of fine to coarse sand and gravel with interstitial clay. The top of the Magothy is not planar, unlike the surfaces of the underlying units. The Magothy surface was deeply eroded during Tertiary time. The surface was ice shoved and probably eroded again during the Pleistocene. In portions of the northern part of the Town of Oyster Bay the Raritan Clay and the Magothy Formation have been completely removed and replaced with younger materials during the Pleistocene. In these areas, the Port Washington aquifer and the Port Washington confining unit were deposited.

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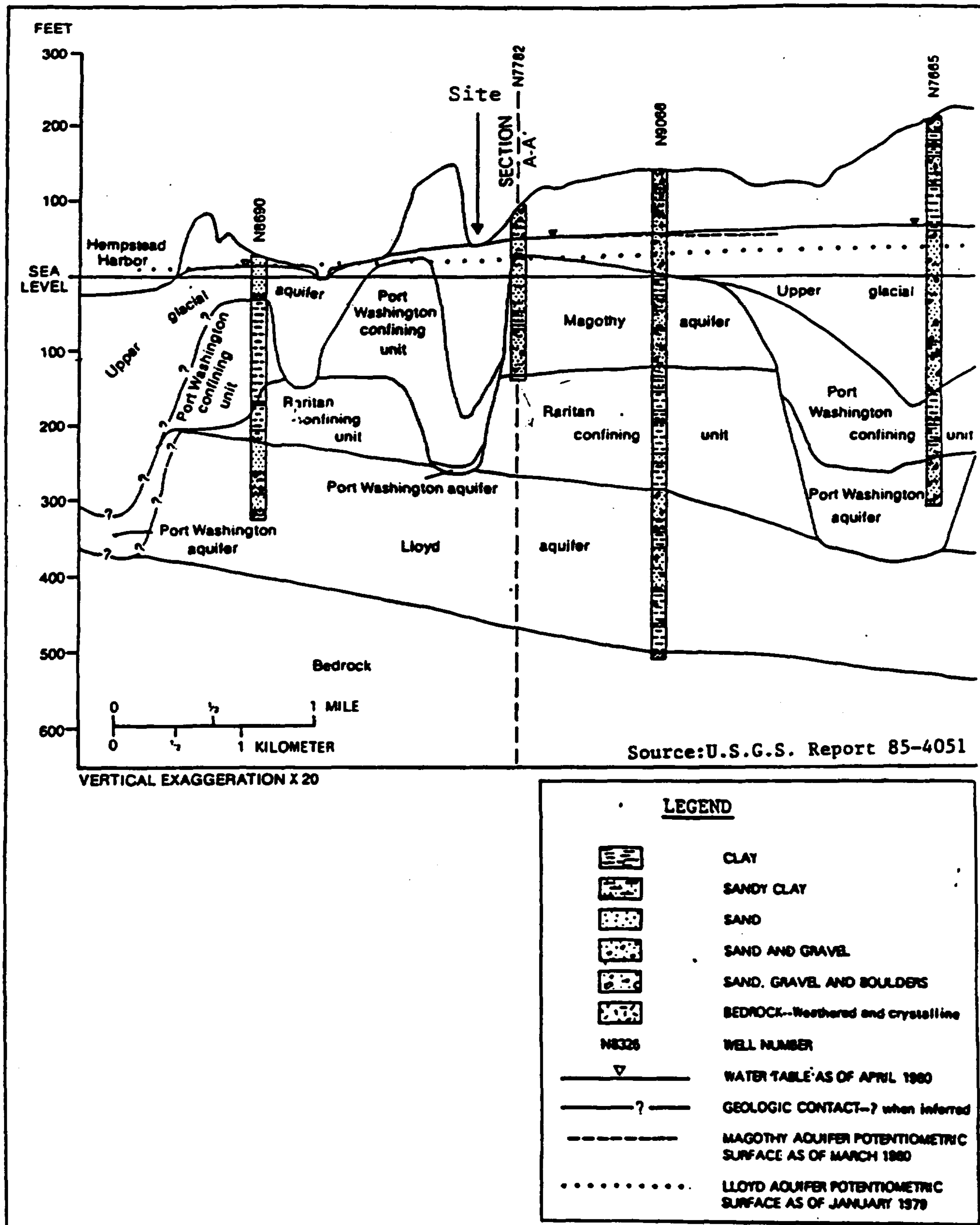


Figure 1-4 East/West Regional Geologic Cross Section

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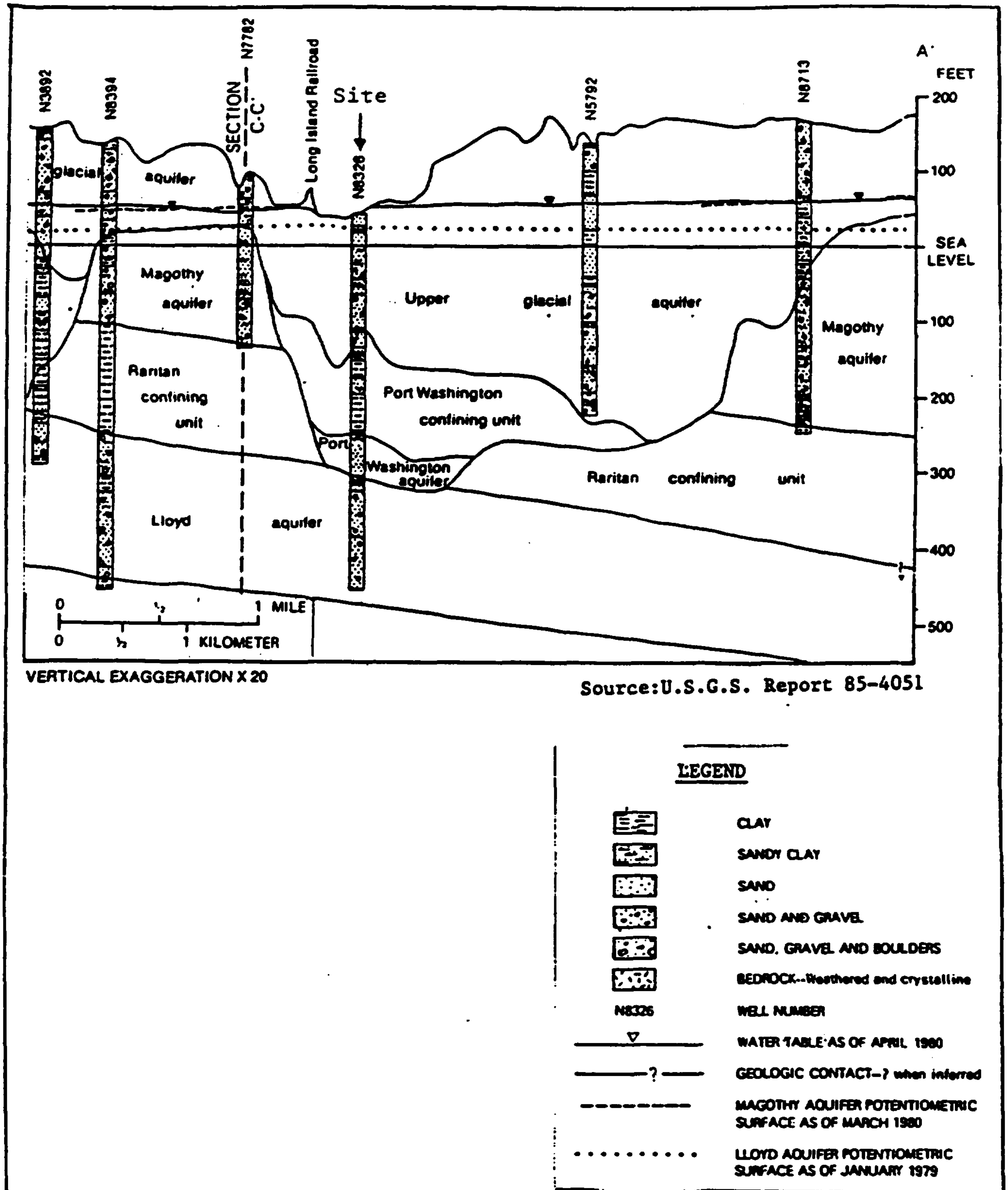


Figure 1-3 North/South Regional Geologic Cross Section

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19.f119

The Port Washington aquifer is a sequence of deposits of Pleistocene and/or Late Cretaceous age. These beds consist of sand, sand and gravel, and varying amounts of interbedded clay, silt and sandy clay. The beds of the Port Washington aquifer form part of the valley fill in the channels cut into the Cretaceous deposits by the glaciers. The Port Washington aquifer and the Lloyd aquifer are apparently hydraulically connected at the study area.

The Port Washington confining unit, which also forms part of the valley fill, is a sequence of deposits of Pleistocene or Late Cretaceous to Holocene? age that locally lies above the Port Washington aquifer or overlaps the local Cretaceous deposits. This unit consists mainly of clay and silt, with scattered lenses of sand or sand and gravel. This unit may include or consist of erosional remnants of the Raritan Clay.

The surface of the Port Washington confining unit features topographic highs and buried valleys into which the Upper glacial aquifer was deposited. Northwest of the Sea Cliff Avenue industrial zone the buried valley of the Port Washington confining unit features a northwesterly to southeasterly trending axis. The apparent deepest elevation of the buried valley is -150 ft. below sea level with the valley walls rising to sea level on each side (see Figure 1-5). It is noted that the regional horizontal groundwater flow direction in the upper glacial aquifer is towards the northwest at the study site, paralleling the valley axis (see Figure 1-6). For this study, the surface of the Port Washington confining unit will represent the base of the aquifer.

The uppermost formation consists of glacial deposits of Late Pleistocene age (upper glacial aquifer). These deposits consist of beds of fine to coarse stratified sand and gravel, but also contain thin discontinuous beds of silt, clay and tills. The upper glacial aquifer overlies the Port Washington confining unit and contains the water table. Table 1-1 shows the approximate surface elevations

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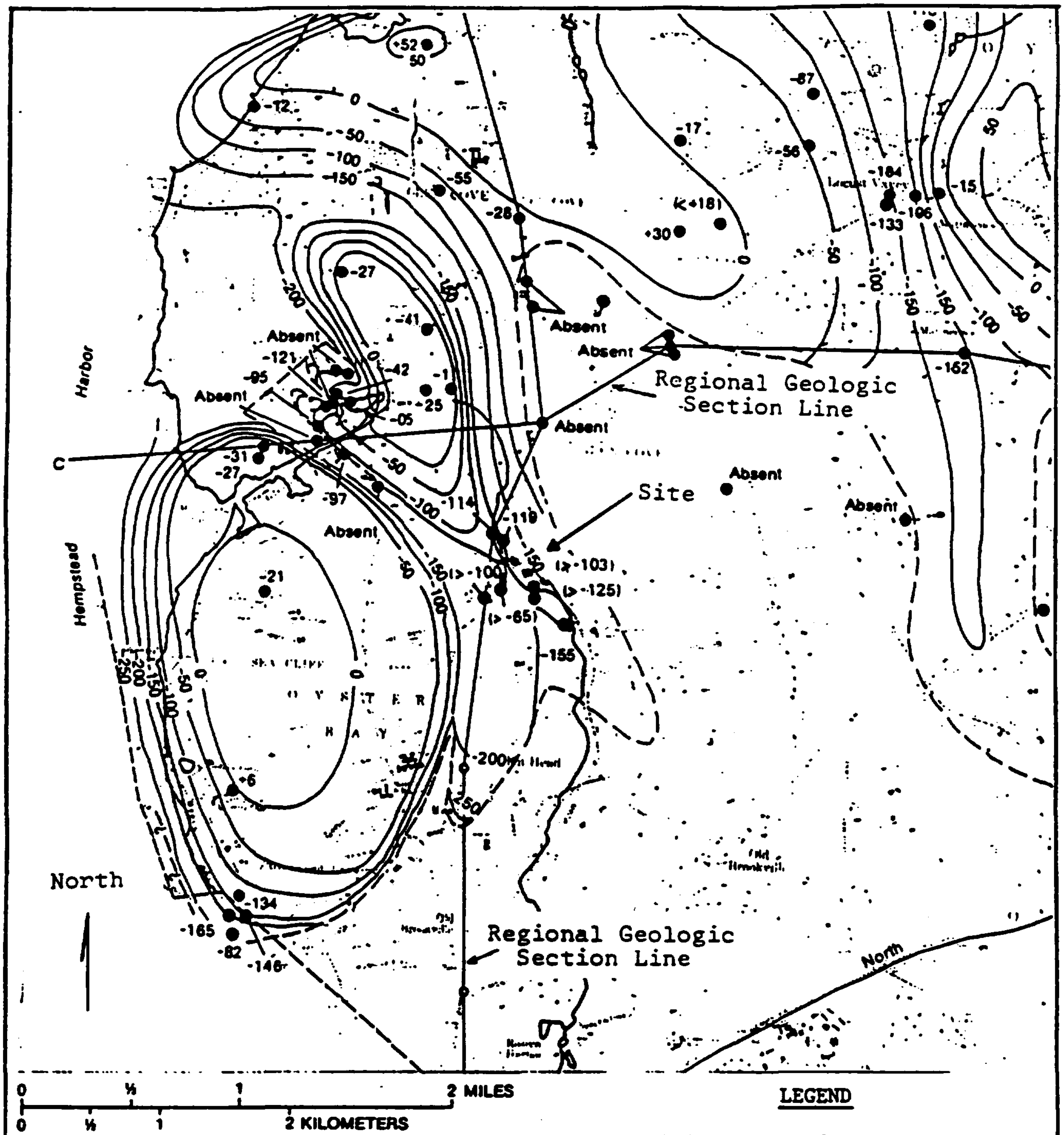


LEGEND

—100— Line of Equal Confining Unit Surface Altitude

• -152 Well Data Point

------- Inferred extent of Confining Unit

Source: U.S.G.S. Report 85-4051

Figure 1-5

Altitude and Configuration of the Port Washington Confining Unit

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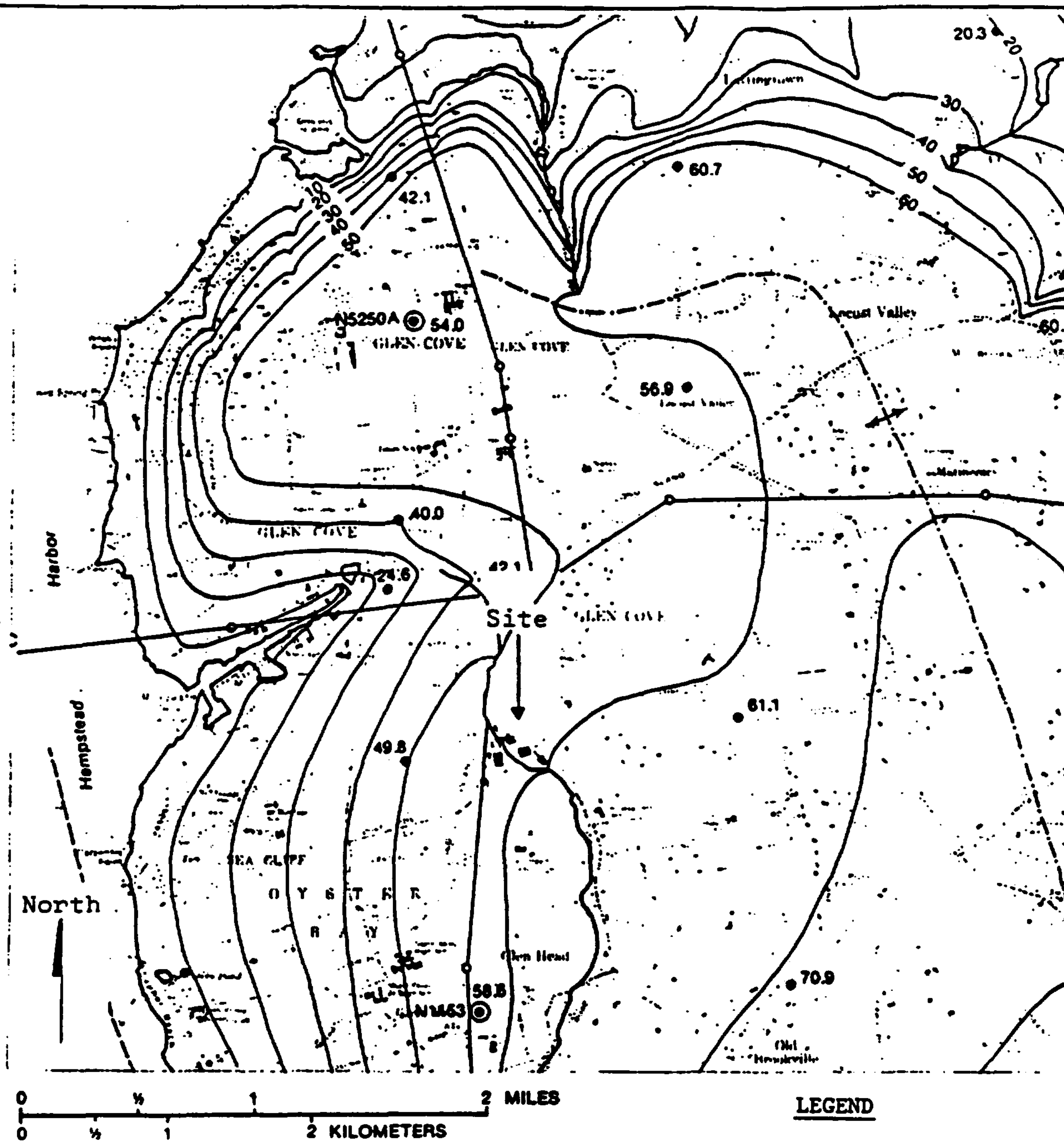


LEGEND

—30— Line of Equal Water Table Altitude

• 49.8 Well Data Point

⊙ N5250A Hydrograph Data Point and Well Number

—·‡·— Local Water Table Divide

Source: U.S.G.S. Report 85-4051

Figure 1-6 Water Table Configuration in 1980

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TABLE 1-1

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK

REGIONAL GEOLOGIC FORMATIONS

| FORMATION NAME | APPROXIMATE FORMATION SURFACE ELEVATION RELATIVE TO SEA LEVEL (FT) | APPROXIMATE FORMATION THICKNESS (FT) |
|---|---|---|
| Upper Glacial Aquifer | 50 to 165 | 150 to 300 |
| Port Washington Confining Unit | -50 to -150 | 100 to 150 |
| Port Washington Aquifer | -250 | 50 |
| Lloyd Aquifer | -300 | 170 |
| Bedrock | -470 | - |

and thicknesses of the regional geologic formations at the study area.

## 1.6 Water Quality

A groundwater quality database of the Sea Cliff Avenue area has been developed since 1977. This was accomplished through the routine sampling by the County Departments of Health and Public Works of industrial, public water supply and groundwater monitoring wells. The primary wells of interest include industrial supply wells 2316, 6579, 7427, 8224 and 8887, and restricted City of Glen Cove public supply wells 3466,8326 and 8327. Please refer to Section 1.9 for details relative to the well owners, well construction and individual well locations.

Table 1-2 is a historic water quality summary of the wells in the vicinity of Sea Cliff Avenue, and includes data collected through early 1988. As indicated in this table, trichloroethylene and tetrachloroethylene, common industrial solvents, were the two primary volatile organic compounds detected in both the industrial and public supply wells. Additional compounds include 1,1,1-trichloroethane, 1,1-dichloroethane and 1,1-dichloroethylene. Sporadic low levels of trichlorofluoroethane, chloroform and benzene were also detected.

Table 1-3 is a summary of the recent water quality sampling from mid 1988 through 1989. Generally, the types and levels of organic compounds are similar to those detected in the historic sampling, however, concentations of 1,1-dichloroethylene and total cis-and trans-dichloroethylene (potential breakdown compounds from trichloroethyene and tetrachloroethylene) are higher than previously detected. Appendix G encloses the full historical water quality statistical summary and the recent sampling results.

# TABLE 1-2

## INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
## CITY OF GLEN COVE
## NASSAU COUNTY, NEW YORK

### HISTORICAL WATER QUALITY SUMMARY (1977 – 1988)
### SEA CLIFF AVENUE VICINITY

### INDUSTRIAL SUPPLY WELLS (7427, 8224, 8887, 6579 AND 2316)

| COMPOUND | CONCENTRATIONS MINIMUM AND MAXIMUM (ug/l) | | |
|---|---|---|---|
| | 1977 – 1980 | 1981 – 1984 | 1985 – 1988 |
| Trichloroethylene | 5 – 600 | 40 – 160 | 3 – 1900* |
| Tetrachloroethylene | 3 – 24 | 4 – 16 | 2 – 14 |
| 1,1,1-Trichloroethane | 2 – 9 | 1 – 19 | 2 – 11 |
| 1,1-Dichloroethane | – | 8 – 25 | 7 – 28 |
| 1,1-Dichloroethylene | – | 1 – 6 | – |

### CARNEY STREET PUBLIC SUPPLY WELLS (3466, 8326, AND 8327)

| COMPOUND | CONCENTRATIONS MINIMUM AND MAXIMUM (ug/l) | | |
|---|---|---|---|
| | 1977 – 1980 | 1981 – 1984 | 1985 – 1988 |
| Trichloroethylene | 1 – 300 | 1 – 380 | 93 – 690 |
| Tetrachloroethylene | 2 – 375 | 1 – 64 | 7 – 46 |
| 1,1,1-Trichloroethane | 1 – 20 | 2 – 18 | 2 – 14 |
| 1,1-Dichloroethane | – | 11 – 16 | 7 – 12 |
| 1,1-Dichloroethylene | – | 1 – 3 | 1 – 3 |
| Trichlorofluoroethane | 4 – 22 | 3 | 6 |
| Chloroform ** | 1 – 20 | – | 2 |
| Benzene | – | 4 | – |

* Well 6579 reported one reading of 1900 ug/l.
** Chloroform may be due to laboratory procedures.
See Section 1-9 for Well Owners, Construction Information and Well Location.
Refer to Appendix G for complete water quality tables.

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TABLE 1-3

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK

RECENT WATER QUALITY SUMMARY (1988 - 1989)
SEA CLIFF AVENUE VICINITY

INDUSTRIAL SUPPLY WELLS (7427, 8224, 8887 AND 2316)

| COMPOUND | CONCENTRATIONS MINIMUM AND MAXIMUM (ug/l) |
|---|---|
| Trichloroethylene | 16 - 260 |
| Tetrachloroethylene | 2 - 21 |
| 1,1,1-Trichloroethane | 2 - 11 |
| 1,1-Dichloroethane | 1 - 28 |
| C & T-1,2-Dichloroethylene | 28 - 210 |
| Chloroform | 5 - 11 |
| Vinyl Chloride | 8 |

CARNEY STREET PUBLIC SUPPLY WELLS (3466, 8326, AND 8327)

| COMPOUND | CONCENTRATIONS MINIMUM AND MAXIMUM (ug/l) |
|---|---|
| Trichloroethylene | 210 - 580 |
| Tetrachloroethylene | 13 - 46 |
| 1,1,1-Trichloroethane | 3 - 6 |
| 1,1-Dichloroethane | 4 - 10 |
| C & T-1,2-Dichloroethylene | 100 - 280 |

NCDPW MONITORING WELL G-4 (1152)

| COMPOUND | CONCENTRATIONS MINIMUM AND MAXIMUM (ug/l) |
|---|---|
| Trichloroethylene | 2 |
| Tetrachloroethylene | 57 - 190 |
| 1,1,1-Trichloroethane | 1 |
| Cis 1,2-Dichloroethylene | 2 |

Well 6579 restricted for drinking in 1977
See Section 1-9 for Well Owners, Construction Information and Well Location
Refer to Appendix G for complete water quality tables

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## 1.7 Land Use

The primary land uses within the study area shown in Figure 1-1 are residential, commercial, industrial, institutional, and open space/recreational.

Residential development, which accounts for the greatest portion of land use in the study area, is mainly low to medium density with two to four units per acre. Primary residential development occurs southwest, west, northeast, and northwest of the Sea Cliff Avenue/Carney Street well field area. Commercial activity exists along Cedar Swamp Road and Glen Street. A high concentration of commercial development exists within the downtown business district, between Glen Street and the Glen Cove Arterial Highway.

Industrial facilities are generally concentrated along Sea Cliff Avenue, which runs east to west approximately 1000 ft. south of the Carney Street well field. Additional industrial activity is located in the northeast section of the study area along Glen Cove Creek.

Institutional development (primarily schools and churches) is scattered throughout the study area within residential areas and along commercial axes. The Glen Head Country Club, located south of the Sea Cliff Avenue industrial area, accounts for the majority of open space/recreational land use. A City of Glen Cove park, whose access is off of Leech Circle South, is located immediately northwest of the Carney Street well field.

## 1.8 Industrial Profile

An industrial profile was developed for the Sea Cliff Avenue industrial zone in order to determine potential sources of groundwater contamination through a historical survey and inventory of chemical usage and storage. The industrial profile area, shown in Figure 1-7, is located east of the Long Island Railroad, north of Glen Head Country Club, and south of Elm Avenue. It is comprised of an assortment of industrial and commercial facilities including electronic and

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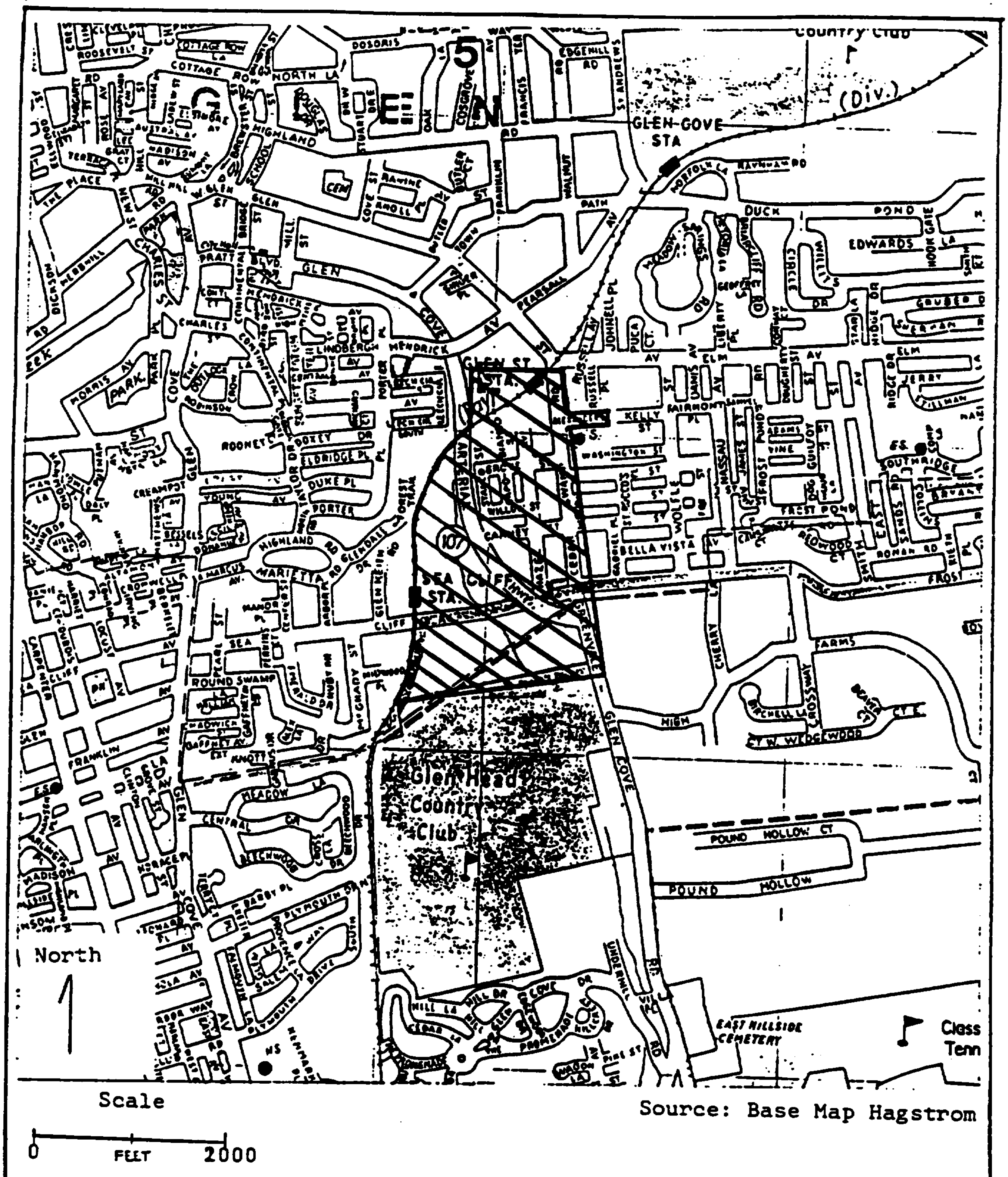


Figure 1-7 Sea Cliff Avenue Industrial Profile Area

electrical equipment manufacturing, metal fabrication, automotive repair, furniture repair, optical and medical goods manufacturing, wholesale and retail trade establishments, and a variety of service industries.

The initial profile was completed in 1977 and subsequently updated in 1988 as part of this study. Over seventy-eight (78) inspections/surveys were conducted at commercial and industrial sites in the profile area. The profile area includes fifty-four (54) active and twenty-four (24) inactive sites. Each facility was surveyed for chemical usage, storage, and waste disposal methods practiced between 1977 and 1988. Interviews were conducted by Health Department personnel with appropriate facility representatives to determine the type of business, number of employees, sources of water supply, sewage disposal, annual chemical usage, annual chemical waste generation and waste disposal practices. Surveyed facilities were grouped according to the Standard Industrial Classification (SIC) code as indicated on Table 1, enclosed in Appendix A. This table includes the fifty four active businesses.

A summary of the industrial chemical profile is outlined in Tables 2 and 3 of Appendix A and includes historical information on both active and inactive facilities. This summary is based upon NCHD records and interviews, information provided in the "Report on Industrial Waste Survey -City of Glen Cove" by William F. Cosulich Associates, October 1974, the "Report on Industrial Waste Survey for the City of Glen Cove" by Sidney B. Bowne and Son, July 1968, and from information provided by the New York State Department of Environmental Conservation (NYSDEC) Industrial Chemical Survey (ICS) program. Also enclosed in Appendix A are two NCDH 1977 and 1978 reports discussing the organic contamination of the Carney Street Well Field.

Figure 1-8, which includes a map and key, locates each of the active businesses in the industrial profile area. Facilities no longer in business but

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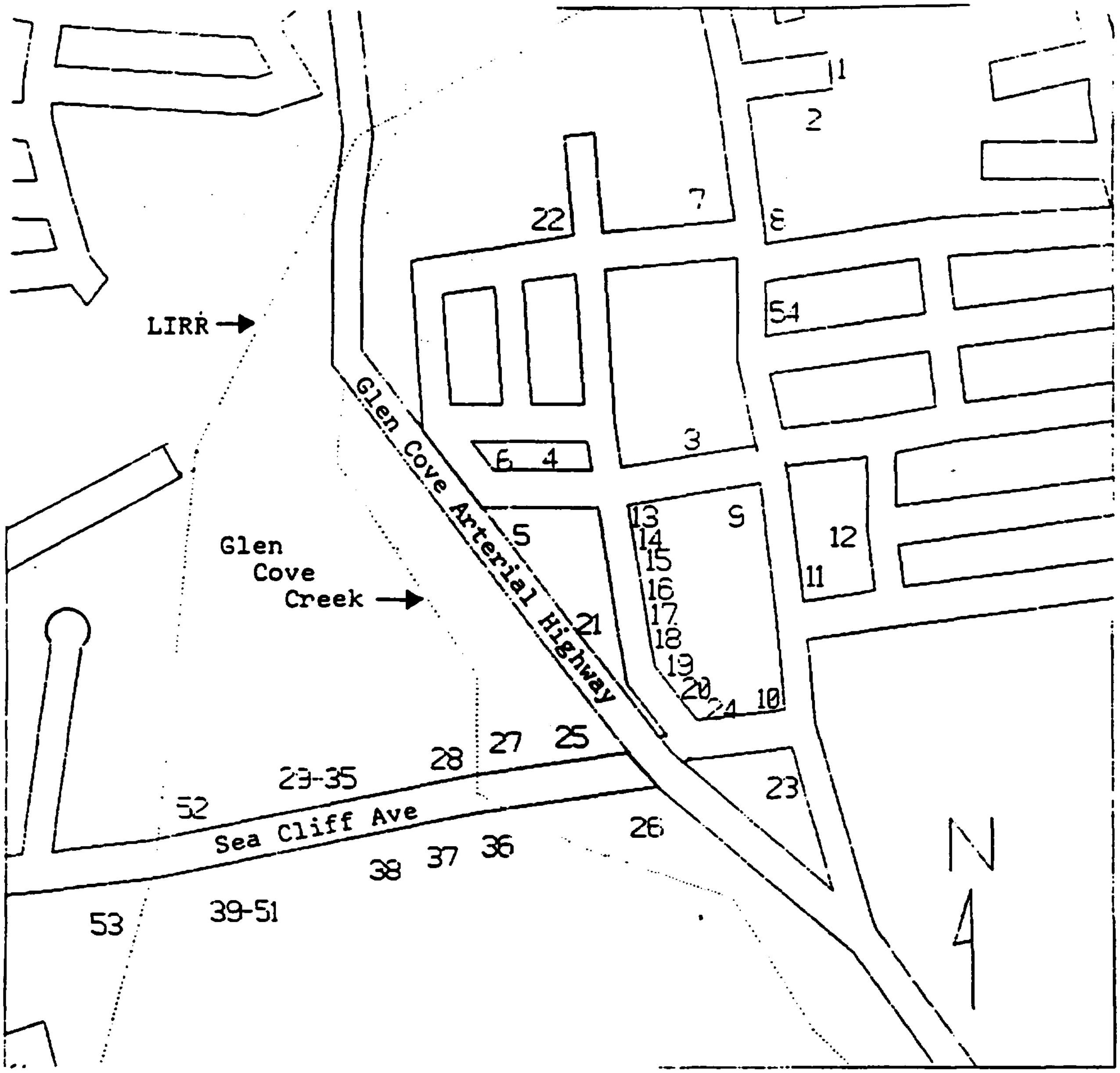


Figure 1-8 Study Area Business Locations

**FIGURE 1-8 KEY**

**INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK**

**KEY TO STUDY AREA BUSINESS LOCATIONS**

| NO. | FACILITY NAME | STREET ADDRESS | FORMER OCCUPANTS |
|---|---|---|---|
| 1 | North Hills Electronics | Alexander Pl | CHIU Technical Corp. |
| 2 | Micronics Corp. | 7 Alexander Pl | Vesuvio Cheese Inc. |
| 3 | Odin Claims | 4 Carney St | |
| | (a) | 10 Carney St | |
| 4 | Glen Cove Iron Works | 34 Carney St | |
| 5 | Man Product | 100 Carney St | |
| 6 | Glen Cove Bowl | 200 Carney St | |
| 7 | Rallye Motors | 20 Cedar Swamp Rd | |
| 8 | Mahoney Auto Parts | 33 Cedar Swamp Rd | |
| 9 | M. L Bianconi Funeral Home | 62 Cedar Swamp Rd | |
| 10 | Luyster Motors | 70 Cedar Swamp Rd | |
| 11 | ANG's Service Station | 73 Cedar Swamp Rd | |
| 12 | Angelina Izzo & Sons | 3 Gabriel St | |
| 13 | Romm Art Creations | 79 Hazel St | GC Fashions Manufacturing<br>Mattiace Petrochemicals |
| 14 | TMBA Energy Cost Control | 79 Hazel St | |
| 15 | Factory Service Parts & Controls | 81 Hazel St | |
| 16 | Long Island Video | 83 Hazel St | |
| 17 | Aqua Scooter | 85 Hazel St | Acco-Bristol Datamaster |
| 18 | Shadow Box | 85 Hazel St | |
| 19 | Greenvale Auto Parts | 85 Hazel St | |
| 20 | Max Wiener & Co./Learsi Leather | 88 Hazel St | Osrow Products/Moonshine Products |
| 21 | Photocircuits | 90 Hazel St | Easter Unlimited |
| 22 | Village Laundromat | Hazel St/Grove St | |
| 23 | Joy Edd Trim Shop | 1 Sea Cliff Ave | |
| 24 | Hinkle & Finlayson/Harbor Fuel Oil | 10 Sea Cliff Ave | |
| 25 | Pall Corporation | 30 Sea Cliff Ave | |
| 26 | Photocircuits | 31 Sea Cliff Ave | |
| 27 | August Thomsen Corp. | 36 Sea Cliff Ave | Glen Components (Div. of Pall) |
| 28 | Associated Drapery Equipment | 40 Sea Cliff Ave | HMS Machine Shop |
| 29 | Earl Electric Mfg. | 44 Sea Cliff Ave | |
| 30 | American Best Coffee | 44 Sea Cliff Ave | |
| 31 | Lau's Cabinets | 44 Sea Cliff Ave | Eastern-Bennett Heat Treatment Co. |
| 32 | Philip C. Antico Consultants | 44 Sea Cliff Ave | Hadax Electronics (Doryt Systems) |
| 33 | Orobello Inc. | 44 Sea Cliff Ave | Quadraframe |
| 34 | One Step Food Supply | 44 Sea Cliff Ave | Telco Inc. |
| 35 | Slater Development Corp. | 44 Sea Cliff Ave | |
| 36 | Slater Electric | 45 Sea Cliff Ave | |
| 37 | Keyco Inc. | 45B Sea Cliff Ave | |
| 38 | Zoomar Inc. | 55 Sea Cliff Ave | |

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# FIGURE 1-8 KEY

## INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
## CITY OF GLEN COVE
## NASSAU COUNTY, NEW YORK

### KEY TO STUDY AREA BUSINESS LOCATIONS

| NO. | FACILITY NAME | | STREET ADDRESS | FORMER OCCUPANTS |
|---|---|---|---|---|
| 39 | Sun Carting | | 59 Sea Cliff Ave | |
| 40 | Sea Cliff Coal and Lumber | | 59 Sea Cliff Ave | |
| 41 | Epco (Apco) Plastics | | 59 Sea Cliff Ave | |
| 42 | William T. Geertseen Landscaping | | 59 Sea Cliff Ave | |
| 43 | T&D Autobody Works | | 59 Sea Cliff Ave | |
| 44 | Tudors Auto Club | | 59 Sea Cliff Ave | Stasi Woodworking Co. |
| 45 | F&J Precision Tooling | | 59 Sea Cliff Ave | (Stasi Kitchens) |
| 46 | R-Tex Decoratives | | 59 Sea Cliff Ave | Raquette Sales |
| 47 | Let Byegones Be | | 59 Sea Cliff Ave | |
| 48 | Sea Cliff Auto Radiator | | 59 Sea Cliff Ave | |
| 49 | Walter J. Moretto Masonary | | 59 Sea Cliff Ave | |
| 50 | Sea Cliff Iron Works | | 59 Sea Cliff Ave | |
| 51 | Monte Displays | | 59 Sea Cliff Ave | |
| 52 | Cove Tennis Center | | 60 Sea Cliff Ave | |
| 53 | LI Glass & Mirror | (b) | 65 Sea Cliff Ave | Pall Corp. |
| 54 | JC Covino Electric | | 3 Second St | |

NOTE:

| | | |
|---|---|---|
| (a) This location now an apartment house | 10 Carney St | Kolco Canvas Products<br>Carney Street Auto Repair |
| (b) LI Glass & Mirror moved to 65 Sea Cliff Ave from this location | 63 Sea Cliff Ave | Rosco Labs<br>The Olde Cabinet Shop<br>Lawrence Mills<br>Nippon Electric Co.<br>Pikwhit Industries<br>Olympic International LTD |

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which operated at these sites are also noted in the key. Table 1-4 is a summary from the industrial chemical profile (Appendix A) of those companies in the vicinity of the Carney Street well field who use or have used organic chemicals. It should be noted that primary contaminants detected in the groundwater at the Sea Cliff Avenue industrial zone are common to those reported in the industrial profile and include tetrachloroethylene, trichloroethylene, 1,1,1-trichloroethane, and their associated potential breakdown products dichloroethylene and dichloroethane.

1.8.1 State Pollution Discharge Elimination System (SPDES) Permits

There are two facilities in the industrial profile area that have had or will require SPDES permits from the NYSDEC. These facilities are as follows:

1. Slater Electric, 45 Sea Cliff Avenue - Issued SPDES Permit NY 1016241 effective 1/1/79 through 1/1/84 for the discharge of 360,000 gallons per day (gpd) of noncontact cooling water from two private wells on site. Originally the discharge was recharged on-site through one diffusion well. However, this well failed and three additional diffusion wells were installed as replacements by January 1981. The permit was deleted by the NYSDEC on October 31, 1986.

   Samples of water before recharge to the diffusion wells were collected by the NCDH on November 8, 1979, November 10, 1982, July 7, 1984 and January 30, 1986. Copies of the analysis results are attached (see Table 4, Appendix A) and, although these results do not illustrate the presence of a continous source of contamination, they do indicate that the discharged water was contaminated on two occasions with organic chemicals. The contamination in the discharge is consistent with the contamination detected in the wells used as the source of the cooling water (please see section 1.6).

2. Photocircuits, 31 Sea Cliff Avenue - Applied in January 1989 for a SPDES

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TABLE 1–4

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK

INDUSTRIAL CHEMICAL PROFILE – GLEN COVE

ORGANIC CHEMICAL SUMMARY

| NAME OF INDUSTRY | LOCATION | ORGANIC CHEMICALS USED | PRESENT STATUS (1) | CHEMICAL USAGE |
|---|---|---|---|---|
| HMS Machine Shop | 40 Sea Cliff Avenue | Possible TCE and PCE | Closed in 1969 | Unknown (2) |
| Pall Corp | 30 Sea Cliff Avenue | PCE, TCE used up to 1972. Small volumes PCE, TCE bought 1987. | Active | (2) |
| Photocircuits | 31 Sea Cliff Avenue | PCE used in 1956, switched to 111 TCA prior to 1966 | Active | (2) |
| Micronics | 7 Alexander Place | Acetone, Freon, Pride FCA blend | Active | Approx. 20 gal/yr |
| North Hills Electric | Alexander Place | 111 TCA in 1977. Freon in 1978. | Active | 75 gal/yr 275 gal/yr |
| Slater Electric | 45 Sea Cliff Avenue | PCE (1977 survey) 111 TCA (1977 Survey) | Active | 4500 gal/yr 375 gal/yr |
| Telco Inc. | 44 Sea Cliff Avenue | 111 TCA (1977 Survey) | Moved in 1983 | 110 gal/yr |
| Zoomar Inc. | 55 Sea Cliff Avenue | Acetone Purline Solvent | Active | 20 gal/yr (2) |

(1) Refer to Appendix A for description of present status
(2) Refer to Appendix A.

PCE – Tetrachloroethylene
TCE – Trichloroethylene
111 TCA – 1,1,1-Trichloroethane

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permit for discharge of noncontact cooling water from two private wells on site to ten diffusion wells on-site. The permit with interim and final discharge limits will be considered by the NYSDEC when an engineering report is submitted indicating how the facility will meet applicable discharge standards. The discharge presently is contaminated with organic chemicals in levels above the allowable standards. The contamination detected in the discharge is consistent with the contamination detected in the wells used as the source of the cooling water (please see section 1.6).

1.8.2 Hazardous Waste Sites

There are no existing Federal or State hazardous waste sites located in the study area. However, in April 1979 the Photocircuits Corp., 31 Sea Cliff Avenue, was listed by NYSDEC as a known or suspected hazardous waste disposal site but subsequently eliminated from the list due to insufficient information. In addition, the site was also listed in November 1981 by the United States Environmental Protection Agency (USEPA) as a Quick Look Hazard System Site - a "potential" site which may pose an "actual health or environmental threat" and which needs to be assessed to determine if a hazardous waste problem exists.

1.8.3 County Permits

There are seven industrial facilities permitted by the NCDH for the storage, handling and control of toxic and hazardous materials under Nassau County Public Health Ordinance (NCPHO) Article XI. These facilities include:

1. Luyster Motors, 70 Cedar Swamp Avenue
2. Man Products, 100 Carney Street
3. North Hills Electronics, 1 Alexander Place
4. Pall Corporation, 30 Sea Cliff Avenue
5. Photocircuits, 31 Sea Cliff Avenue

Ref. 28
350 P/19

6. Rallye Motors, 20 Cedar Swamp Avenue

7. Slater Electric, 45 Sea Cliff Avenue

More specific information concerning the types of stored chemicals is presented in the Industrial Chemical Profile (Tables 2 and 3, Appendix A).

1.8.4 Spills

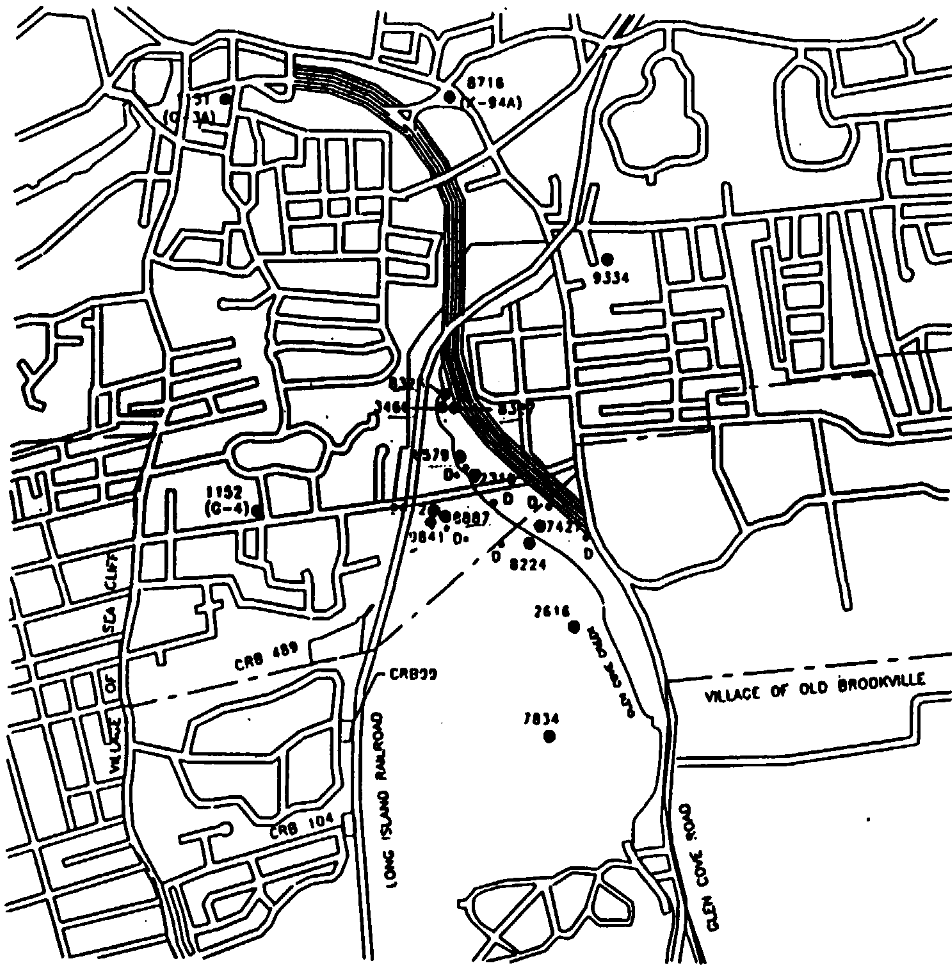
There were a number of reports filed with NCDH concerning spills of petroleum products/organic chemicals which occurred in the study area.

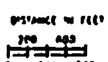
1. Photocircuits, 31 Sea Cliff Avenue - On May 24, 1989 a 20,000 gallon underground No. 2 fuel oil tank was removed from this site. There were no visible holes in the tank, but contaminated soil was noted in the vicinity of the piping. Sixty (60) cubic yards of oil contaminated soil was removed. No further action was required by the NYSDEC.

2. Slater Electric, 45 Sea Cliff Avenue - On November 30, 1987, a 10,000 gallon underground No. 2 fuel oil tank failed a leak test. The tank was abandoned in place in February 1988 and a monitoring well was installed in November 1988. No floating oil was detected on the water table. NYSDEC requires the well to be tested once each month.

1.9 Existing Wells and Pumpage

Figure 1-9 shows the locations of the existing industrial, monitoring and water supply wells within an approximate one mile radius of the Sea Cliff Avenue industrial zone. Table 1-5 shows individual well construction, present status, and a summary of the 1988 pumpage data as reported to the NYSDEC. In 1988, the Photocircuits Corp. pumped 1.1 million gallons per day (gpd) for non-contact cooling water purposes and 530,000 gpd for air conditioning during the demand season. This water is supplied by two supply wells and diffused on-site through 10 diffusion wells. Slater Electric pumped 150,680 gpd in 1988 for non-contact cooling water purposes and is also diffusing on-site. The Pall Corporation pumped



LEGEND

- ● 7427 EXISTING INDUSTRIAL WELL
- ● 9115 EXISTING NASSAU COUNTY (H-4A) DPW MONITORING WELL
- ● 'D DIFFUSION WELL CLUSTER
- ● D•, DIFFUSION WELL ESTIMATED LOCATION

| NO | REVISION DESCRIPTION | DATE |
|---|---|---|
| B | FIRST RELEASE | [illegible] |
| A | FOR INFORMATION ONLY | [illegible] |

COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY

FIGURE 1-9
GLEN COVE STUDY AREA
INDUSTRIAL WATER SUPPLY AND
EXISTING MONITORING WELLS

| HAZARDOUS WASTE UNIT | DWG NO | DRAWN BY | SHEET NO |
|---|---|---|---|
| | [illegible] | [illegible] | 1 OF 1 |



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TABLE 1-5

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK

EXISTING PUBLIC SUPPLY, INDUSTRIAL AND MONITORING WELLS

| WELL NUM | OWNER | MEASURING POINT ELEV. (FT) | SCREEN INTERVAL ABOVE OR BELOW SEA LEVEL (FT) | AQUIFER | USE | 1988 PUMPAGE (GPD) |
|---|---|---|---|---|---|---|
| 7834 | Glen Head CC | 150 | -21 to -52 | UG | Irrigation | |
| 2626 | Glen Head CC | 75 | -109 to -146 | UG | Irrigation | |
| 8224 | Photocircuits | 58 | -46 to -97 | UG | Air Cond | 530,000 |
| 7427 | Photocircuits | 58 | -62 to -103 | UG | Ind. Cool | 1,137,000 |
| 7452 | Photocircuits | NA | 75 to 107** | UG | Diffusion | |
| 7453 | Photocircuits | NA | 90 to 122** | UG | Diffusion | |
| 8028 | Photocircuits | NA | 72 to 120** | UG | Diffusion | |
| 8930 | Photocircuits | NA | 74 to 125** | UG | Diffusion | |
| 8931 | Photocircuits | NA | 74 to 125** | UG | Diffusion | |
| 9773 | Photocircuits | NA | 131 to 182** | UG | Diffusion | |
| 10107 | Photocircuits | NA | 105 to 183** | UG | Diffusion | |
| 8887 | Slater Electric | 65 | -40 to -65 | UG | Ind. Cool | Combined |
| 9612 | Slater Electric | NA | 109 to 134** | UG | Ind. Cool | 150,680 |
| 9841 | Slater Electric | NA | 96 to 121** | UG | Ind. Cool | On Demand |
| 9614 | Slater Electric | NA | 135 to 185** | UG | Diffusion | |
| 8892 | Slater Electric | NA | 114 to 159** | UG | Diffusion | |
| 8987 | Slater Electric | NA | 41 to 72** | UG | Diffusion | |
| 9615 | Slater Electric | NA | 135 to 185** | UG | Diffusion | |
| 9693 | Slater Electric | NA | 135 to 185** | UG | Diffusion | |
| 6579 | August Thomsen | 57 | -73 to -89 | UG | Restr in 1977 | |
| 2316 | Pall Corp. | 75 | to -110 | UG | Air Cond | 64,000 |
| 7153 | Pall Corp. | NA | 31 to 42** | UG | Diffusion | |
| 7154 | Pall Corp. | NA | 26 to 36** | UG | Diffusion | |
| 7155 | Pall Corp. | NA | 18 to 27** | UG | Diffusion | |
| 7919 | Pall Corp. | NA | 152 to 190** | UG | Diffusion | |
| 8886 | Pall Corp. | NA | 140 to 180** | UG | Diffusion | |
| 3466 | Glen Cove City | 53 | -95 to -120 | UG | PWS Aban * | |
| 8326 | Glen Cove City | 53 | -67 to -112 | UG | PWS Restr * | |
| 8327 | Glen Cove City | 53 | -65 to -115 | UG | PWS Aban * | |
| 9334 | Glen Cove City | 143 | -100 to -150 | M | PWS *** | |
| 4980 | Zoomar Industries | NA | NA | NA | NA | |
| 1151 | NCDPW G-3A | 34 | -5 to -9 | UG | Monitoring | |
| 1152 | NCDPW G-4 | 154 | 28.5 to 23.5 | UG | Monitoring | |
| 9115 | NCDPW H-4A | 145 | 40 to 35 | UG | Monitoring | |
| 8716 | NCDPW X-94A | 47 | 27 to 22 | UG | Monitoring | |

NA – Not Available
UG – Upper Glacial
M – Magothy
* – Public Water Supply Well Abandoned or Restricted
** – Denotes the total depth of the well
*** – Well 9334, City of Glen Cove's Kelly Street Well, voluntarily removed from service in January 1989. Air-stripping treatment being installed.



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64,000 gpd for air conditioning (in season) during the same year, and is also diffusing on-site. Active wells are routinely sampled as discussed in Section 1.6. According to and in conjunction with the NYSDEC (section 1.8), the Photocircuits Corp. is presently designing an industrial cooling water air stripping treatment system to be utilized prior to diffusion on-site.

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## 2.0 DESCRIPTION OF MONITORING AND SAMPLING PROGRAMS

### 2.1 Monitoring Well Site Selection

A thorough review of all existing hydrogeologic reference material was conducted to assist in the development of a monitoring well network to characterize the three dimensional extent of the groundwater contamination. This included a review of the hydrogeology as described by Kilburn and Krulikas (USGS, 1987), existing geologic logs and well construction data (NYSDEC, NCDPW and USGS), the development of a water table contour map from existing NCDPW groundwater elevation data, and the review of historic water quality data compiled by the NCDH and NCDPW monitoring programs. Based upon this data, preliminary well placements were selected and field confirmed. Monitoring wells were subsequently installed at county right-of-ways, New York State right-of-ways, and City of Glen Cove property in a two-phased approach. Thirteen monitoring wells were installed during the Phase One investigation; seven additional monitoring wells and one well point were installed during the Phase Two investigation. Due to the presence of overhead electric wires along the north and south sides of Sea Cliff Avenue, which prevented safe drilling operations, monitoring wells were not installed in the industrial zone. However, a shallow-driven well point was constructed along the right-of-way during Phase Two. The Phase Two wells were installed after assessment of the Phase One water quality and hydrologic data.

Water table wells and deep well clusters were installed to establish the water table and deep flow regimes, water table and deep groundwater quality and to quantify vertical groundwater gradients. The deep well screens were set at elevations comparable to the City of Glen Cove's Carney Street wells or slightly deeper. These elevations were generally at the base of the upper glacial aquifer and slightly above the surface of the Port Washington confining unit. The screen elevation of monitoring well GC-1D (deep upgradient background well clustered with

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upgradient water table well GC-1S), was set at the same elevation as the Carney Street supply wells above the surface of the Port Washington confining unit and below a locally significant confining unit.

## 2.2 Drilling Methods

Monitoring wells were installed by Hydro Group, Inc., Hauppauge, NY, utilizing the hollow stem auger and direct mud rotary drilling methods. A single well point was driven as part of this study. All drilling was supervised by NCDPW hydrogeologists and NCDH personnel. Split spoon soil samples were generally taken over twenty foot intervals or at select intervals as directed by the hydrogeologist (refer to Boring Logs, Appendix B, and Soil Sampling, Section 2.9.) Drill cuttings were continuously observed and logged. The hollow stem auger installations produced a 12-inch diameter borehole. The direct mud rotary method produced an 8-inch diameter borehole. The drilling fluid for mud rotary installations was composed of quick gel bentonite and potable water. Continual air monitoring was accomplished with either a Century (Foxboro) Model 128 Organic Vapor Analyzer (OVA) or a HNu photoionization detector (PID).

## 2.3 Monitoring Well Construction

Table 2-1 is a list of the construction details for the monitoring wells installed during the study. Figure 2-1 shows the monitoring well locations. Monitoring wells GC-1S, 2S, 3S, 4S, 7S, 9S and 10S were drilled by the hollow stem auger method. All other wells, with the exception of the well point, were drilled by direct mud rotary methods. All wells were constructed following the NYSDEC's State Superfund Phase II protocol, as shown in Figure 2-2, however, all wells were set flush to grade. All wells were constructed with Schedule 40 flush joint threaded NSF approved polyvinyl chloride (PVC) casing with 20 ft. of 0.020 inch slot NSF approved Schedule 40 PVC well screen. The well screen was packed with #2 Morie gravel to a minimum of two feet above the top of the well screen. A Wyoming

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TABLE 2-1

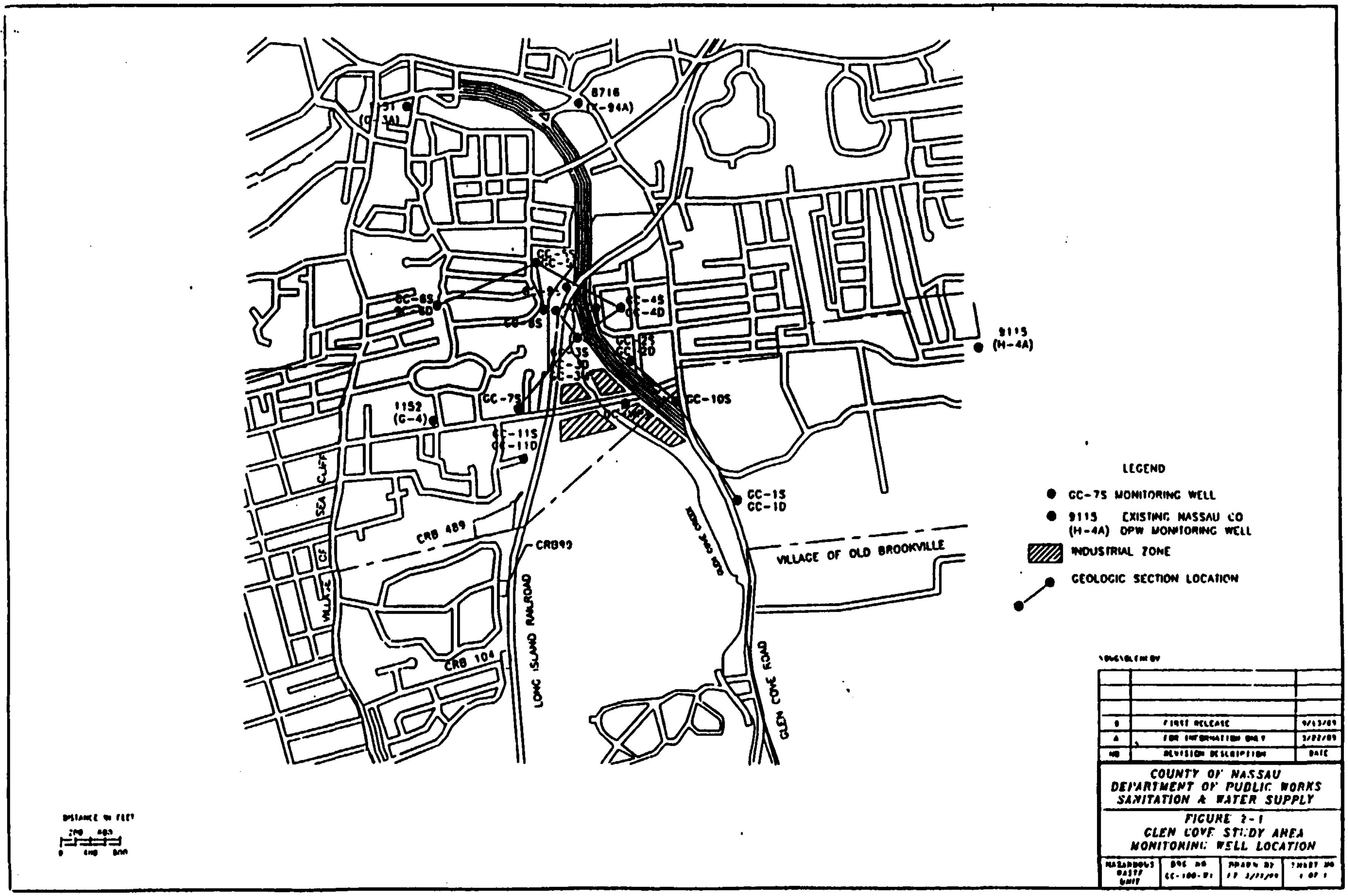
INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK

MONITORING WELL CONSTRUCTION

| WELL | MEASURING POINT ELEVATION (TOP PVC) | ELEVATION TOP SCREEN | ELEVATION BOTTOM SCREEN | TOTAL DEPTH | WATER ELEVATION 1/17/90 | DRILLING METHOD | AQUIFER |
|---|---|---|---|---|---|---|---|
| GC-1S | 78.25 | 59.4 | 39.4 | 39 | 58.59 | Auger | UG |
| GC-1D | 78.18 | -96.6 | -116.6 | 195 | 58.19 | Mud Rotary | UG |
| GC-2S | 74.80 | 55.8 | 35.8 | 39 | 57.44 | Auger | UG |
| GC-2D | 74.39 | -113.9 | -133.9 | 209 | 55.98 | Mud Rotary | UG |
| GC-3S | 51.98 | 48.3 | 28.3 | 24 | 47.98 | Auger | UG |
| GC-3M | 53.94 | -39.7 | -59.7 | 114 | 50.42 | Mud Rotary | UG |
| GC-3D | 52.48 | -127.3 | -147.3 | 200 | 50.66 | Mud Rotary | UG |
| GC-4S | 88.44 | 54.7 | 34.7 | 54 | 54.04 | Auger | UG |
| GC-4D | 88.75 | -110.9 | -130.9 | 220 | 54.78 | Mud Rotary | UG |
| GC-5S | 138.42 | 53.1 | 33.1 | 106 | 47.40 | Mud Rotary | UG |
| GC-5D | 138.47 | -95.2 | -115.2 | 254 | 47.59 | Mud Rotary | UG |
| GC-6S | 161.73 | 32.2 | 12.2 | 150 | 48.22 | Mud Rotary | UG |
| GC-6D | 162.02 | -92.7 | -112.7 | 275 | 47.88 | Mud Rotary | UG |
| GC-7S | 120.51 | 41.2 | 21.2 | 100 | 50.67 | Auger | UG |
| GC-8S | 135.13 | 48.5 | 28.5 | 107 | 49.02 | Mud Rotary | UG |
| GC-8D | 94.44 | -74.5 | -94.5 | 189 | 48.92 | Mud Rotary | UG |
| GC-9S | 90.27 | 49.7 | 29.7 | 61 | 46.42 | Auger | UG |
| GC-10S | 76.41 | 56.5 | 36.5 | 40 | 55.47 | Auger | UG |
| GC-11S | 133.49 | 38.8 | 18.8 | 115 | 51.29 | Mud Rotary | UG |
| GC-11D | 133.81 | -76.9 | -96.9 | 231 | 51.60 | Mud Rotary | UG |
| GC-WP1 | 59.98 | 55.0 | 50.0 | 10 | 56.07 | Driven | UG |

All measurements in feet above or below (-) sea level
Elevations surveyed by NCDPW
UG - Upper Glacial

15-B

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DEPARTMENT OF PUBLIC WORKS
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NASSAU COUNTY, NEW YORK

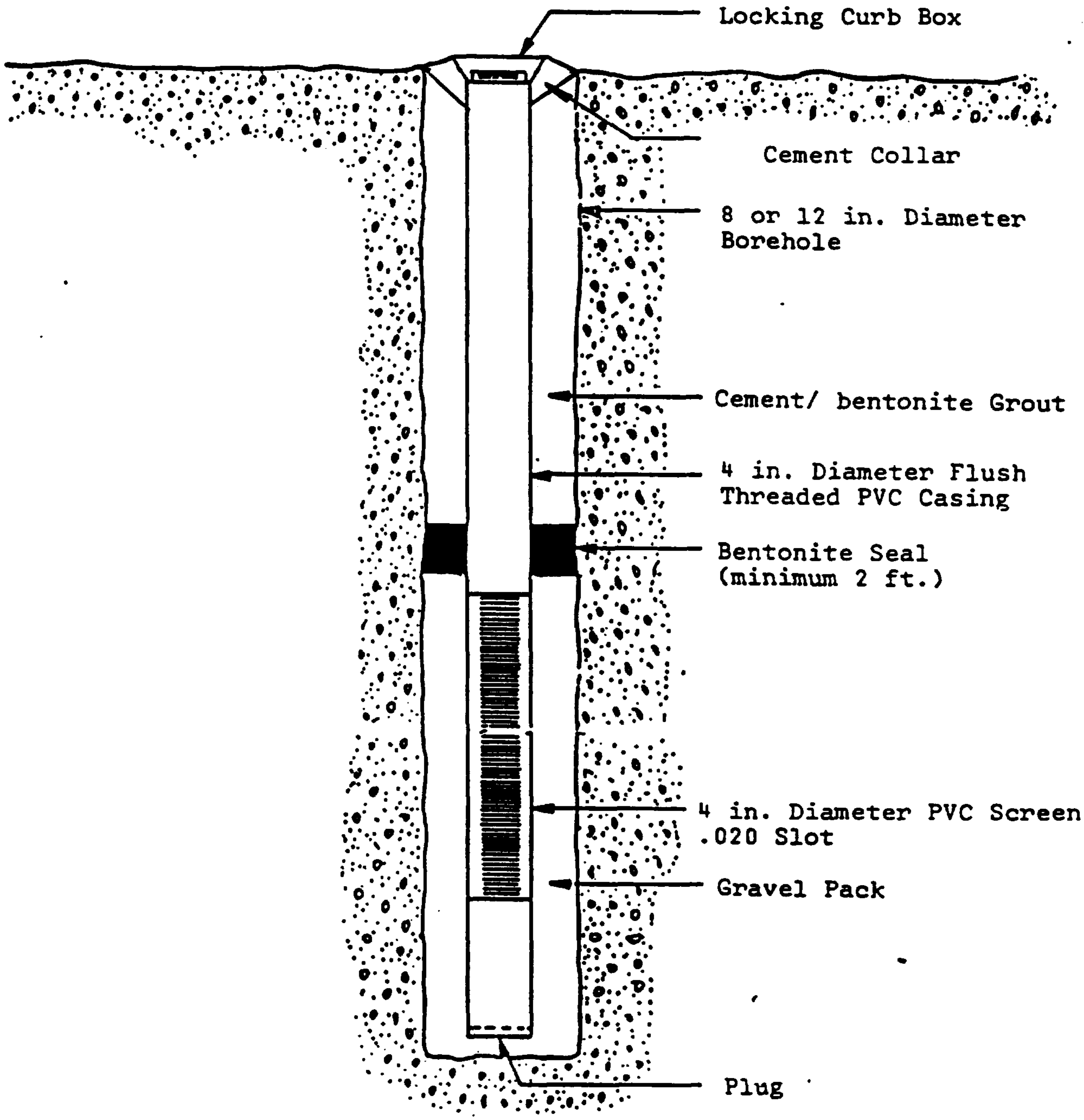


Figure 2-2 Monitoring Well Construction Detail

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bentonite pellet seal, with a minimum thickness of two feet, was placed above the gravel pack. The remaining annular space was grouted to the surface with a cement/bentonite slurry. A locking cap was installed at the top of each well and the well was cemented flush to grade in a bolted valve box. The well point was constructed of five feet of 0.012 inch slot stainless steel screen coupled to five feet of galvanized steel pipe. Specific sampling, lithologic and construction details can be found in the well logs in Appendix B.

## 2.4 Well Development

Immediately after construction, all wells were developed by over pumping with a submersible pump for a minimum of one hour. The well point was hand surged and bailed with a stainless steel bailer. Specific well pumping rates and times are described in the well logs in Appendix B.

## 2.5 Well Logging

All monitoring wells were logged through a combination of techniques. For both the hollow stem auger and direct mud rotary drilling methods drill cuttings were continually logged by the hydrogeologist. Lithologic split spoon soil samples were generally taken over twenty-foot intervals, or as directed by the hydrogeologist. The drilling rig's response through the different formations was also noted. In addition, monitoring wells 1D, 2D, 3D, 4D, 5D, 6D, 8D and 11D were gamma logged with a Mineral Logging Services Model No. 1501 Gamma Logger. From this data the geologic well logs and cross-sections were produced. The gamma logs are included in Appendix C.

## 2.6 Well Construction QA/QC

Before all well drilling, the drill rig and all down hole drilling equipment were thoroughly steam cleaned. The split spoon soil sampler was steam cleaned prior to each boring effort and was washed with Liquinox and potable water between sampling efforts. All well development equipment was thoroughly steam cleaned



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before all developing efforts.

2.7 Water Levels

After well construction, the elevation of the top of the PVC casing was determined to the nearest hundreth of an inch (mean sea level datum) by a survey crew from the NCDPW Division of Highways and General Engineering. All water levels were measured with a chalked steel tape and referenced to the top of the PVC casing. Water levels were completed prior to each sampling effort to determine the volume of groundwater to be purged per well. Synoptic water levels were completed at the wells over a period of approximately two hours for the development of water elevation maps for both the water table and the deep upper glacial aquifer. (see Hydrogeology Results, Section 3-2.) Additionally, three benchmarks were established at concrete culverts along Glen Cove Creek to determine the elevation of the creek during base flow periods. These base flow creek elevations were taken synoptically with water table measurements.

2.8 Water Quality Sampling

One round of groundwater quality sampling was completed after the installation of the Phase One wells and two additional rounds were completed after the installation of the Phase Two wells. Three to five well volumes of groundwater were purged at each well prior to sampling. During the purging process, the pH, specific conductance and temperature of the discharging groundwater were monitored until stabilization of these parameters had been attained. Monitoring of well parameters was completed with a YSI-3500 Water Quality Monitor and a Hanna Instruments Model 0624-00 pHep-pH electronic gauge. Appendix D encloses the pH, specific conductance and temperature data for each well for the first sampling effort.

Well purging was completed with a Standard Pump Type 14x4P 1/2 horsepower submersible pump, a Keck Geophysical Model SP-81 submersible pump or a Homelite centrifugal pump, depending on depths to water and well volumes. Well pumps or intake hoses were set just below the stabilized drawdown water level during purging to ensure evacuation of all standing water in the well casing. Monitoring wells 1D, 2D, 4D, 5D, 6S, 6D, 7S, 8D, 11S, 11D and G-4 (1152) were purged with the Standard submersible pump. Monitoring wells 1S, 2S, 4S, 5S, 8S, 9S and 10S were purged with the Keck submersible pump. Monitoring wells 3S, 3M and 3D were purged with the Homelite centrifugal pump. Well point GC-WP1 was hand bailed.

Groundwater sampling was completed following USEPA protocol with decontaminated bottom loading stainless steel bailers. Dedicated nylon rope and dedicated vinyl gloves were used at each well and subsequently discarded. The stainless steel bailer and dedicated rope were precluded from making contact with the ground surface. Groundwater samples were poured from the bailer into the appropriate sample bottles in such a way as to minimize agitation and to prevent excessive aeration. All samples were stored on ice until delivery to the laboratory. Chain of Custody sampling sheets were maintained for each sampling event and are enclosed in Appendix E.

2.9 Soil Sampling -Split Spoon

Subsurface soil sampling was completed with a split barrel (split spoon) sampler, 2-inch OD, 1-3/8 inch ID, 27-inch long. The spoon sampler was advanced below either the lead auger or rotary drilling rod and bit into undisturbed formation with a sliding sampling jar. The sampler was then retrieved and the sediments were logged by the hydrogeologist. The split spoon sampler was steam cleaned prior to each boring effort and washed with Alconox and potable water followed by potable water rinse between individual sampling efforts. All soil samples were screened for organic vapors with either the Century Model 128 OVA or the HNu photoionization detector.

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47, P119

## 2.10 Water Sampling QA/QC

Aqueous sampling QA/QC involved the decontamination of all purging and sampling equipment prior to and in between sampling efforts following NYSDEC Superfund Phase II protocol. The Standard Type 14x4P submersible pump and its associated PVC piping and electrical wiring was steamed cleaned prior to and in between sampling efforts. Additionally, the pump was flushed with a mixture of Alconox and potable water after steam cleaning. The Keck Model SP-81 submersible pump was decontaminated by using an Alconox and potable water rinse, a methanol and potable water rinse, followed by a potable water rinse. The centrifugal pump and its associated intake and discharge hoses were steam cleaned prior to and in between purging efforts.

Prior to each daily groundwater sampling event, one bottom loading stainless steel bailer for each well to be sampled was steam cleaned. Dedicated nylon rope and vinyl sampling gloves were used at each well and then discarded. Trip blanks and field blanks were utilized daily as described in Section 2.11. Samples were immediately preserved on ice and delivered to the laboratory. Chain of Custody documents for all sampling events are enclosed in Appendix E.

## 2.11 Analytical Parameters

All samples were analyzed by the NCDH Environmental Laboratory. Two 250 ml water samples were collected at each round; one sample was subsequently analyzed and the second was retained in reserve.

USEPA Method 502.2 entitled, "Volatile Organic Compounds in Water by Purge and Trap Capillary Column Gas Chromatography with Photoionization and Electrolytic Conductivity Detectors in Series" was the analytical method utilized for the water samples. A summary of the procedure is as follows.

Quality Assurance and Quality Control (QA/QC) practices used were as outlined in Method 502.2 as noted above. Highly volatile organic compounds with low water solubility are extracted (purged) from the sample matrix by bubbling an inert gas through a 5 ml aqueous sample. Purged sample components are trapped in a tube containing suitable sorbent materials. When purging is complete, the sorbent tube is heated and backflushed with helium to desorb trapped sample components onto a capillary gas chromatograph (GC) column. The column is temperature programed to separate the analytes which are then detected with a photoionization detector and a halogen specific detector placed in series.

Identification of analytes is obtained by analyzing standards under the same condition used for samples and comparing resultant GC retention times. Additional confirmatory information can be gained by comparing the relative response from the two detectors. Each identified component is quantified using the external standard method.

Field and trip blanks were analyzed for each sampling run performed and their analyses are enclosed in Appendix E. In addition, the following areas of QA/QC are routinely addressed by the NCDH Laboratory's Quality Assurance Program:

- Documentation of day-to-day instrument performance.
- Records of instrument calibrations.
- Preparation of daily control charts.
- Records of personnel accountability to demonstrate chain of custody.
- Periodic laboratory replicate analysis.
- Regular use of laboratory blanks.
- Periodic recovery of standards by the method of standard additions.
- Regular participation in proficiency programs sponsored by regulatory agencies and consultants.
- Regular participation in inter-laboratory splitting of reference samples.
- Records of precision and accuracy.
- Records of instrument repair and preventive maintenance.

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- Regular monitoring of reagent quality.

- Records establishing the quality of reconditioned adsorption tubes.

Full chain of custody procedures and records were kept for all samples taken as part of the project (see Appendix E).

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# 3.0 STUDY RESULTS

## 3.1 Geology

The geology and hydrostratigraphic formations encountered during well installation generally include an upper glacial till of variable composition and thickness, a lower sand and sand and gravel unit with occasional zones of silt, and the Port Washington confining unit composed of clay and sandy clay forming the base of the upper glacial aquifer.

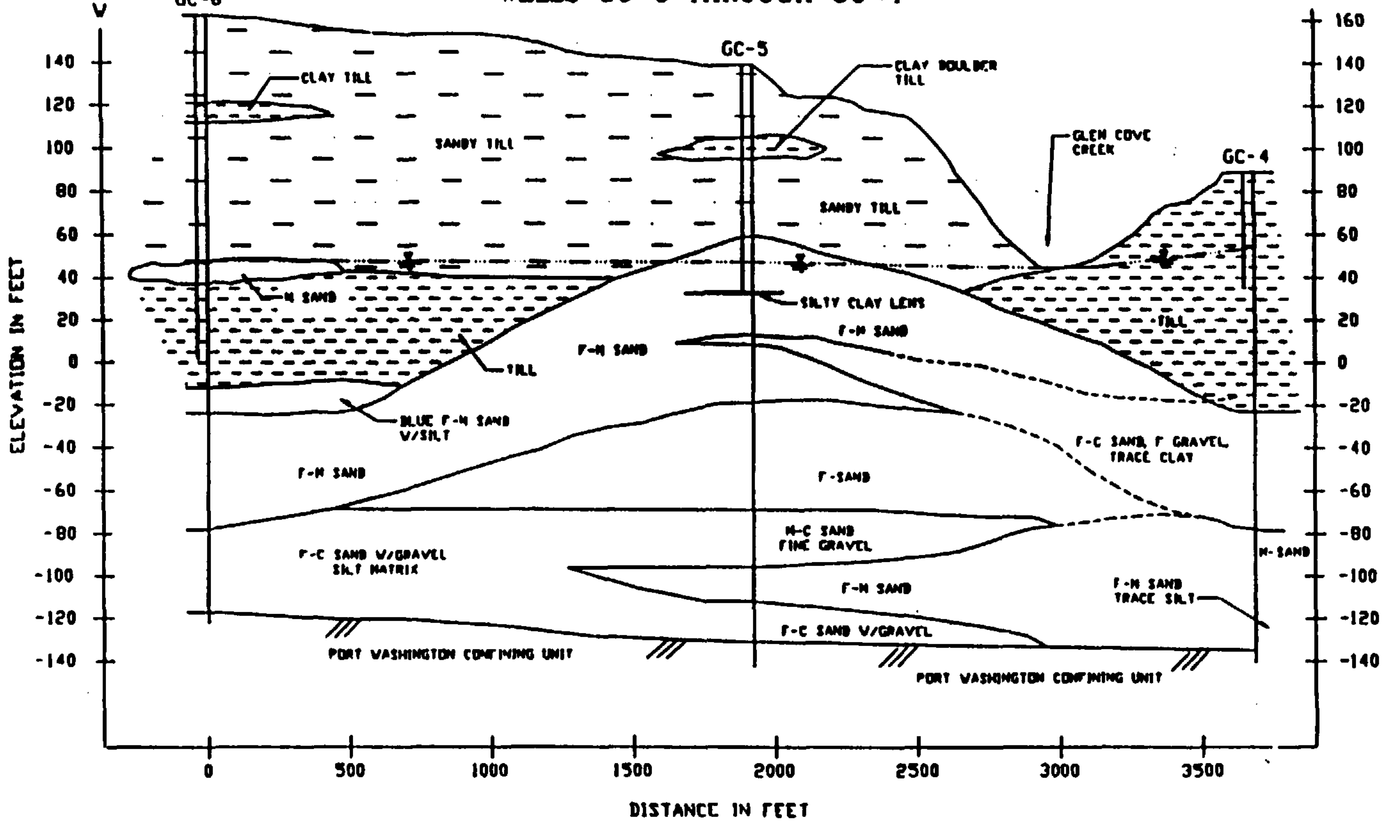
Four geologic cross-sections have been developed, two north to south and two east to west, through analysis of the well logs and gamma logs of the deep monitoring wells. These cross-sections are presented in Figures 3-1 through 3-4.

### 3.1.1 Upper Glacial Till

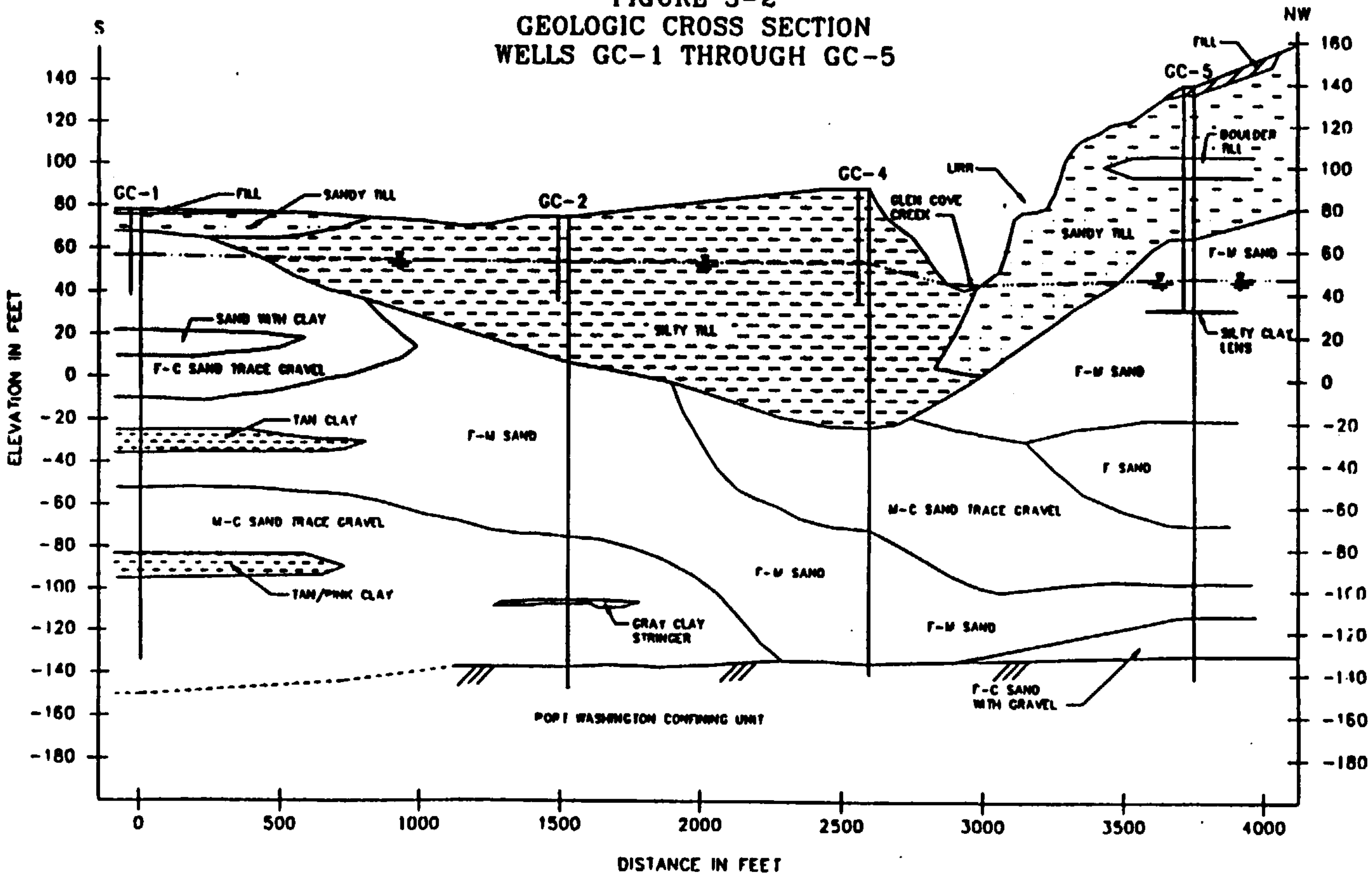
The upper glacial till formation ranges in thickness from 12 to 126 ft. at the well borings. The till varies in composition and can be divided into three separate facies (one part of a rock body as contrasted with other parts). The first has a composition ranging from a silty, clayey, fine-medium sand with gravel to cobbles and occasional boulders (wells GC-2, 3, 4, and 10S); the second, a sandy facies, is composed of compact medium to coarse sand and gravel, with cobbles and occasional zones of silt (wells GC -1, 5 and 7); and the third can be described as an irregular alternating sequence of the silt facies till with the sandy facies till as seen at wells GC-6, 8, 9S and 11. In general, the silty facies till is located east of Glen Cove Creek, while the sandy facies and alternating facies is located west of Glen Cove Creek. At wells GC-1 and 3 a thin fill layer overlies the till. Other observations include:

- o A 5 ft. thick clayey, indurated boulder till logged within the sandy facies at well GC-5 approximately 40 ft. below grade.
- o Sand lenses were logged in the till at wells GC-4, 6, 8S and 8D.
- o A series of clay stringers (ice contact drift?) were logged at well GC-11D

# FIGURE 3-1
## GEOLOGIC CROSS SECTION
## WELLS GC-6 THROUGH GC-4

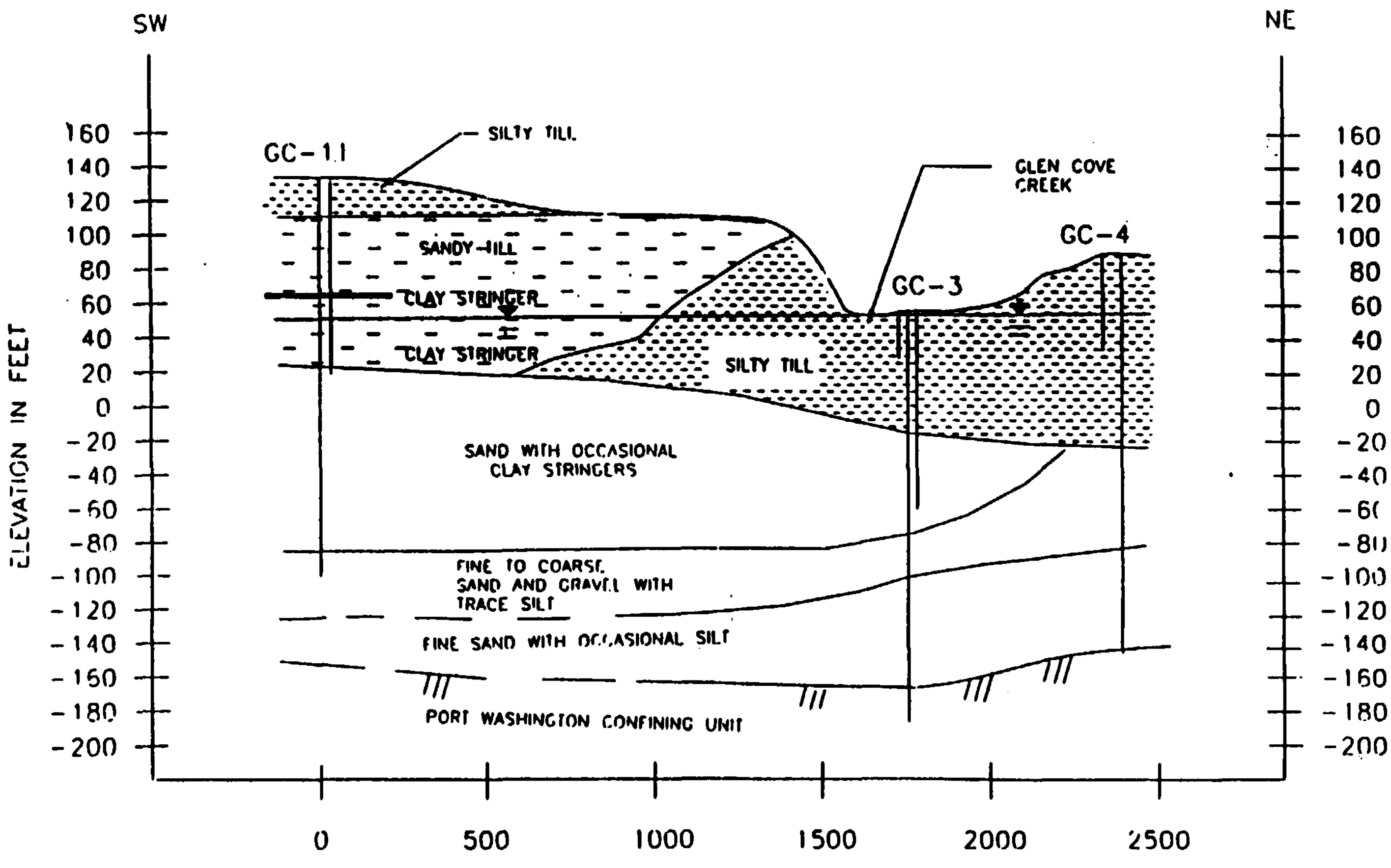


# FIGURE 3-2
# GEOLOGIC CROSS SECTION
# WELLS GC-1 THROUGH GC-5



22-C

# FIGURE 3-3
# GEOLOGIC CROSS SECTION
# WELLS GC-4 THRU GC-11

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22-D

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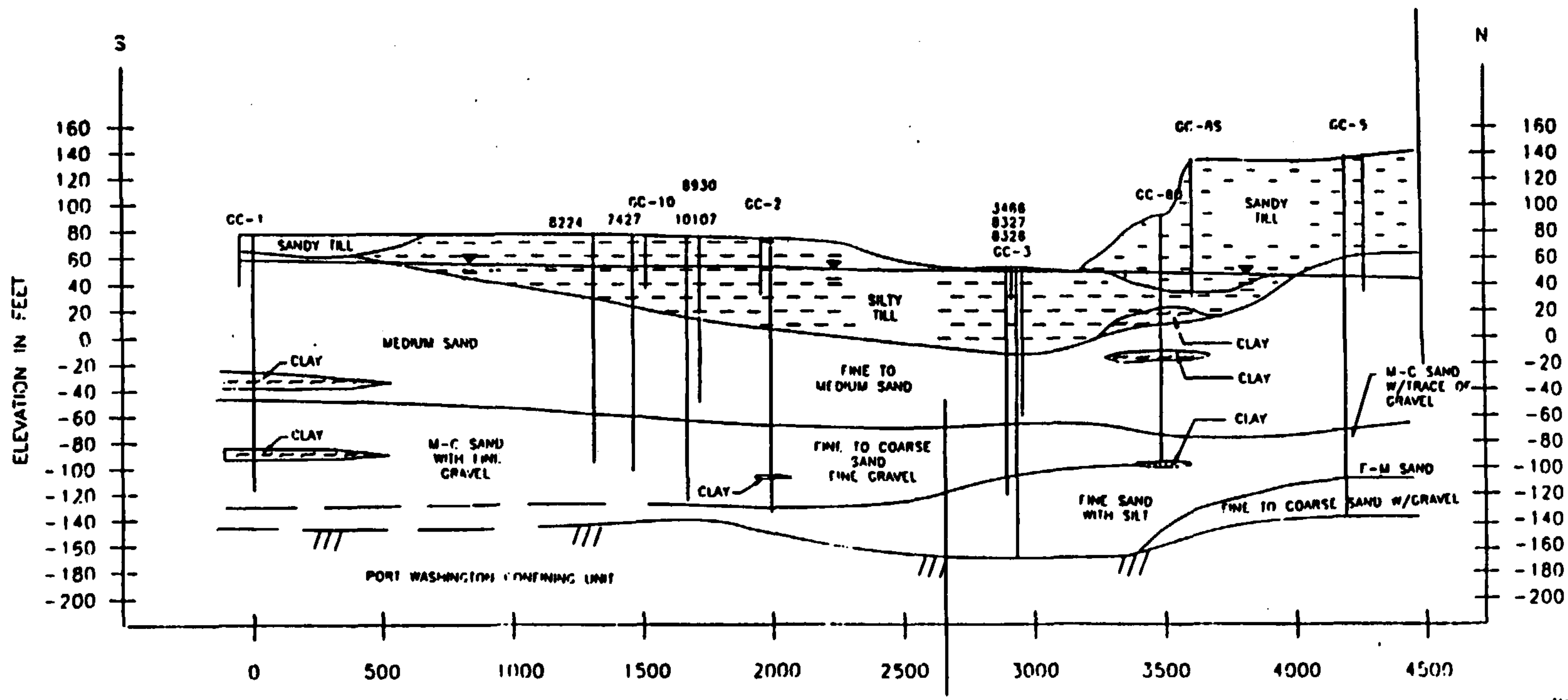
FIGURE 3-4
GEOLOGIC CROSS SECTION
WELLS GC-1 THRU GC-8



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approximately 70 ft. below grade which is 63 ft. asl.

Areas of apparent Cretaceous sediment picked up from the north, transported and incorporated in the till, were identified at well GC-6D, where a blue, fine-medium sand with silt was observed and at well GC-3D, where a multi-colored gray/blue very fine quartz sand in a silt matrix was encountered (see Figures 3-1 through 3-4). Of note is the upper till's heterogeneous nature as shown by its silty and sandy facies, variable compaction, zones of indurated clayey boulder till and incorporated Cretaceous sediments.

3.1.2 Lower Sand and Gravel Formation

Underlying the till and extending down to the surface of the Port Washington confining unit is an interbedded sand and sand and gravel formation with occasional lenses of silt. The thickness of this formation ranges from a high of approximately 216 ft. at well GC-1D to a low of 112 ft. at wells GC-4 and GC-6. Based upon the lithologic data obtained during sampling this formation is composed of hydraulically connected glacial sediment, reworked glacial and Cretaceous sediment, and thrusted or in place Cretaceous sediment. Separation of glacial and Cretaceous sediment was accomplished through color analysis, lithologic examination, degree of weathering and determination of elevation relative to sea level. Defining the stratigraphy more concisely is beyond the scope of this investigation.

Generally, the till is underlain by either glacial or reworked glacial and Cretaceous sediment composed of fine to medium grained quartz sand with occasional traces of fine gravel and silt. Glacial and reworked glacial and Cretaceous sediment were logged to depth at wells GC-1, 10S and 11. At all other wells the glacial and reworked sediment extends to an apparent contact with in-place Cretaceous sediment.

The apparent in-place Cretaceous sediment is generally composed of whitish fine to medium sand with occasional silt, very fine to fine sand with a light silt matrix and a basal fine to coarse weathered quartz sand with fine to medium quartz gravel with occasional silt. The basal sand and gravel unit generally overlies the Port Washington confining unit. The surface altitude of the Cretaceous contact encountered at wells 2, 3, 4, 5, 6 and 8 ranges from -52 to -118 ft. below sea level (bsl). An apparent Cretaceous high was logged at 33 feet asl at well GC-5D. Specific contacts are noted in well logs in Appendix B.

### 3.1.3 Confining Units

The Port Washington confining unit, which forms the base of the upper glacial aquifer, is the most significant areally extensive confining unit at the study area. Other significant but non-continuous confining units were encountered in the lower sand unit at wells GC-1D, 2D, 8D and in the upper till at abandoned boring GC-7D adjacent to well GC-7S (see Figures 3-1 through 3-5). A tan clay was logged from -84 to -93 bsl at well GC-1D. The well screen was set at -96 to -116 bsl (Carney Street supply well elevations range from -65 to -120 bsl). This clay unit pinches out (gradually disappears) to the north. A localized gray clay lens was logged at -105 to -107 bsl at well GC-2D. The GC-2D well screen was set below this clay from -114 to -134 bsl. During the borehole drilling for proposed well GC-7D (Phase Two) a solid light gray clay was encountered at 21 ft. asl. Because the Phase One water quality at GC-7S showed 404 micrograms/liter (ug/L) of total VOC's it was decided not to breach the confining layer. Therefore, the thickness and lower elevation of the clay at this location was not determined. The boring was subsequently grouted to depth. Wells GC-11S and 11D, installed at Midwood Court appoximately 600 ft. to the south (Phase Two), did not encounter the solid clay. Two confining units were encountered at well GC-8D approximately 1,250 ft. to the north of well GC-7S. The surface of the upper clay was logged at 22 ft. asl and is well correlated with the clay logged at GC-7D. The clay is 12 ft. thick at GC-8D.


LEGEND

) EXTENT OF CLAY-DASHED WHERE INFERRED

DISTANCE IN FEET

0 300 600 900 1200

FILE NAME \DWG\CLCHEMAL

| NO | REVISION DESCRIPTION | DATE |
|---|---|---|
| 0 | ORIGINAL RELEASE | 4/23/90 |

COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY
HAZARDOUS WASTE SERVICES UNIT

FIGURE 3-5
AREAL EXTENT OF CLAY
AT 20 FT ABOVE SEA LEVEL

| CONTRACT NUMBER | DWG NO | DRAWN BY | SHEET NO |
|---|---|---|---|
| 58002 | GC-100-01 | J SIMMET 4/10/90 | 1 OF 1 |
| DESIGNED BY | DATE | CHECKED BY | DATE |
| R STONE | 4/1/90 | J DeFRANCO | 4/20/90 |

24-A

103035

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| NO | REVISION DESCRIPTION | DATE |
|---|---|---|
| 0 | ORIGINAL RELEASE | 4/23/90 |

COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY
HAZARDOUS WASTE SERVICES UNIT

FIGURE 1-6
SURFACE ALTITUDE OF PORT WASHINGTON CONFINING UNIT AT STUDY VICINITY

| CONTRACT NUMBER | DWG NO | DRAWN BY | SHEET NO |
|---|---|---|---|
| DESIGNED BY | DATE | CHECKED BY | DATE |

24-B

103036

Ref.28
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The surface of the lower clay was logged at -11 bsl and is 6 ft. thick. Both units pinch out to the north and east as neither clay was logged at wells GC-5D and GC-3D, 700 and 540 ft. to the north and east, respectively. Figure 3-5 shows the areal extent of the clay at approximately 20 ft. asl.

The surface altitude of the Port Washington confining unit, based upon borings installed during this program and USGS report 85-4051, is shown in Figure 3-6. The surface represents the base of the upper glacial aquifer. Drill cuttings of the Port Washington confining unit observed from wells GC-2D, 4D, 5D and 6D were a white, sandy plastic clay, although GC-6D was installed at the contact of the Raritan Clay and Port Washington confining unit as described by Kilburn and Krulikus (USGS, 1987). A hard dark gray clay, however, was logged at well GC-3D, which may represent in-place Raritan Clay.

3.2 Hydrogeology

The hydrogeology of the upper glacial aquifer in the study area was determined through the installation of water table wells, which allowed determination of the water table configuration and flow directions, and through the installation of deep upper glacial wells, which allowed determination of the deep upper glacial potentiometric heads and flow directions. Vertical groundwater gradients and flow components were established by measuring the water table and deep upper glacial hydrostatic heads at the paired well clusters. A Stevens Water Level Recorder was installed at well GC-3D to help quantify the effects of the industrial well pumpage on the deep upper glacial aquifer. Additionally, three bench marks were established at culverts along Glen Cove Creek to allow the determination of the Creek's elevation. The base flow creek elevations were necessary to map the water table configuration.

3.2.1 Water Table Aquifer

Full synoptic rounds to determine groundwater elevations at all wells and the three creek locations were completed four times and are summarized in Tables 3-1 through 3-4. Nonprecipitation conditions for at least two days were a prerequisite to ensure creek base flow discharging conditions. Water table configuration maps are shown in Figures 3-7 through 3-10. The water table contour maps show a general northwesterly regional flow direction with a consistent west to northwest horizontal flow direction south of Sea Cliff Avenue, and northerly flow in the vicinity of Glen Cove Creek.

The influence of Glen Cove Creek appears minimal in the regional water table map (see Figure 1-6); however, as shown in the site-specific water table figures developed during the study, Glen Cove Creek represents a significant water table discharge point, through and immediately north of the industrial zone along Sea Cliff Avenue. Groundwater flow is deflected to the north where the contours "V" around the creek. Increased groundwater gradients exist around and toward the creek, especially between well GC-4S and the creek benchmark established at the culvert south of the railroad overpass, where a gradient of 0.018 ft./ft. existed August 22, 1989. Additionally, the flow direction is southeast between well GC-9S and the benchmark at the railroad overpass, reversed from the regional northwesterly direction. The point of flow inflection is located just west of Glen Cove Creek and apparently is a result of the increased gradients adjacent to the creek, combined with the water table's contact with the thick till wedge logged at GC-6S and the silty till through the water table at well GC-8S. The water table is also located in the upper till unit at wells GC-2S, 3S, 4S, 7S, 9S, 10S, 11S and WP1 and in the lower sand at wells GC-1S and 5S.

Water table elevations are the result of a dynamic balance between precipitation (recharge), the geologic media, discharge and potential effects from

TABLE 3–1

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK

GROUNDWATER LEVELS – AUGUST 22, 1989

| WELL | MEASURING POINT ELEVATION (TOP PVC) | ELEVATION TOP SCREEN | ELEVATION BOTTOM SCREEN | DEPTH TO WATER | WATER ELEVATION | VERTICAL GRADIENT |
|---|---|---|---|---|---|---|
| GC–1S | 78.25 | 59.4 | 39.4 | 21.31 | 56.94 | Downward |
| GC–1D | 78.18 | –96.6 | –116.6 | 21.52 | 56.66 | |
| GC–2S | 74.80 | 55.8 | 35.8 | 17.59 | 57.21 | Downward |
| GC–2D | 74.39 | –113.9 | –133.9 | 19.89 | 54.50 | |
| GC–3S | 51.98 | 48.3 | 28.3 | 4.51 | 47.47 | |
| GC–3D | 52.48 | –127.3 | –147.3 | 2.86 | 49.62 | Upward |
| GC–4S | 88.44 | 54.7 | 34.7 | 34.88 | 53.56 | Downward |
| GC–4D | 88.75 | –110.9 | –130.9 | 35.23 | 53.52 | |
| GC–5S | 138.42 | 53.1 | 33.1 | 91.69 | 46.73 | Downward |
| GC–5D | 138.47 | –95.2 | –115.2 | 91.80 | 46.67 | |
| GC–6S | 161.73 | 32.2 | 12.2 | 113.72 | 48.01 | Downward |
| GC–6D | 162.02 | –92.7 | –112.7 | 114.78 | 47.24 | |
| GC–7S | 120.51 | 41.2 | 21.2 | 70.57 | 49.94 | |
| G–4 | 153.85 | 28.5 | 23.5 | 104.73 | 49.12 | |
| H–4A | 144.71 | 39.4 | 35.4 | 86.73 | 57.98 | |
| **GLEN COVE CREEK** | | | | | | |
| @ Sea Cliff Avenue 59.46 (bench) | | | | 4.15 | 55.31 | |
| @ RR overpass 51.48 (bench) | | | | 10.11 | 41.37 | |
| @ Hendrick 40.83 (bench) | | | | 9.87 | 30.96 | |

All measurements in feet above or below (–) sea level
Elevations surveyed by NCDPW

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TABLE 3-2

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK

GROUNDWATER LEVELS - SEPTEMBER 5, 1989

| WELL | MEASURING POINT ELEVATION (TOP PVC) | ELEVATION TOP SCREEN | ELEVATION BOTTOM SCREEN | DEPTH TO WATER | WATER ELEVATION | VERTICAL GRADIENT |
|---|---|---|---|---|---|---|
| GC-1S | 78.25 | 59.4 | 39.4 | 21.66 | 56.59 | Downward |
| GC-1D | 78.18 | -96.6 | -116.6 | 22.25 | 55.93 | |
| GC-2S | 74.80 | 55.8 | 35.8 | 17.90 | 56.90 | Downward |
| GC-2D | 74.39 | -113.9 | -133.9 | 19.98 | 54.41 | |
| GC-3S | 51.98 | 48.3 | 28.3 | 4.73 | 47.25 | |
| GC-3D | 52.48 | -127.3 | -147.3 | 2.83 | 49.65 | Upward |
| GC-4S | 88.44 | 54.7 | 34.7 | 34.90 | 53.54 | |
| GC-4D | 88.75 | -110.9 | -130.9 | 35.08 | 53.67 | Upward |
| GC-5S | 138.42 | 53.1 | 33.1 | 91.65 | 46.77 | Downward |
| GC-5D | 138.47 | -95.2 | -115.2 | 91.75 | 46.72 | |
| GC-6S | 161.73 | 32.2 | 12.2 | 113.97 | 47.76 | Downward |
| GC-6D | 162.02 | -92.7 | -112.7 | 114.75 | 47.27 | |
| GC-7S | 120.51 | 41.2 | 21.2 | 70.57 | 49.94 | |
| G-4 | 153.85 | 28.5 | 23.5 | 104.71 | 49.14 | |
| H-4A | 144.71 | 39.4 | 35.4 | 86.85 | 57.86 | |
| **GLEN COVE CREEK** | | | | | | |
| @ Sea Cliff Avenue 59.46 (bench) | | | | 3.93 | 55.53 | |
| @ RR overpass 51.48 (bench) | | | | 10.18 | 41.30 | |
| @ Hendrick 40.83 (bench) | | | | 9.80 | 31.03 | |

All measurements in feet above or below (-) sea level
Elevations surveyed by NCDPW



103040

RF.28

63, P119

TABLE 3-3

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK

GROUNDWATER LEVELS – JANUARY 17, 1990

| WELL | MEASURING POINT ELEVATION (TOP PVC) | ELEVATION TOP SCREEN | ELEVATION BOTTOM SCREEN | DEPTH TO WATER | WATER ELEVATION | VERTICAL GRADIENT |
|---|---|---|---|---|---|---|
| GC–1S | 78.25 | 59.4 | 39.4 | 19.66 | 58.59 | Downward |
| GC–1D | 78.18 | -96.6 | -116.6 | 19.99 | 58.19 | |
| GC–2S | 74.80 | 55.8 | 35.8 | 17.36 | 57.44 | Downward |
| GC–2D | 74.39 | -113.9 | -133.9 | 18.41 | 55.98 | |
| GC–3S | 51.98 | 48.3 | 28.3 | 4.00 | 47.98 | |
| GC–3M | 53.94 | -39.7 | -59.7 | 3.52 | 50.42 | |
| GC–3D | 52.48 | -127.3 | -147.3 | 1.82 | 50.66 | Upward |
| GC–4S | 88.44 | 54.7 | 34.7 | 34.40 | 54.04 | |
| GC–4D | 88.75 | -110.9 | -130.9 | 33.97 | 54.78 | Upward |
| GC–5S | 138.42 | 53.1 | 33.1 | 91.02 | 47.40 | |
| GC–5D | 138.47 | -95.2 | -115.2 | 90.88 | 47.59 | Upward |
| GC–6S | 161.73 | 32.2 | 12.2 | 113.51 | 48.22 | Downward |
| GC–6D | 162.02 | -92.7 | -112.7 | 114.14 | 47.88 | |
| GC–7S | 120.51 | 41.2 | 21.2 | 69.84 | 50.67 | |
| GC–8S | 135.13 | 48.5 | 28.5 | 86.11 | 49.02 | |
| GC–8D | 94.44 | -74.5 | -94.5 | 45.52 | 48.92 | |
| GC–9S | 90.27 | 49.7 | 29.7 | 43.85 | 46.42 | |
| GC–10S | 76.41 | 56.5 | 36.5 | 20.94 | 55.47 | |
| GC–11S | 133.49 | 38.8 | 18.8 | 82.20 | 51.29 | |
| GC–11D | 133.81 | -76.9 | -96.9 | 82.21 | 51.60 | Upward |
| GC–WP1 | 59.98 | 55.0 | 50.0 | 3.81 | 56.17 | |
| G–4 | 153.85 | 28.5 | 23.5 | 104.71 | 49.14 | |
| **GLEN COVE CREEK** | | | | | | |
| @ Sea Cliff Avenue 59.46 (bench) | | | | 3.98 | 55.48 | |
| @ RR overpass 51.48 (bench) | | | | 9.35 | 42.13 | |
| @ Hendrick 40.83 (bench) | | | | Not Measured | | |

All measurements in feet above or below (–) sea level
Elevations surveyed by NCDPW

RoF,28
64°F/19

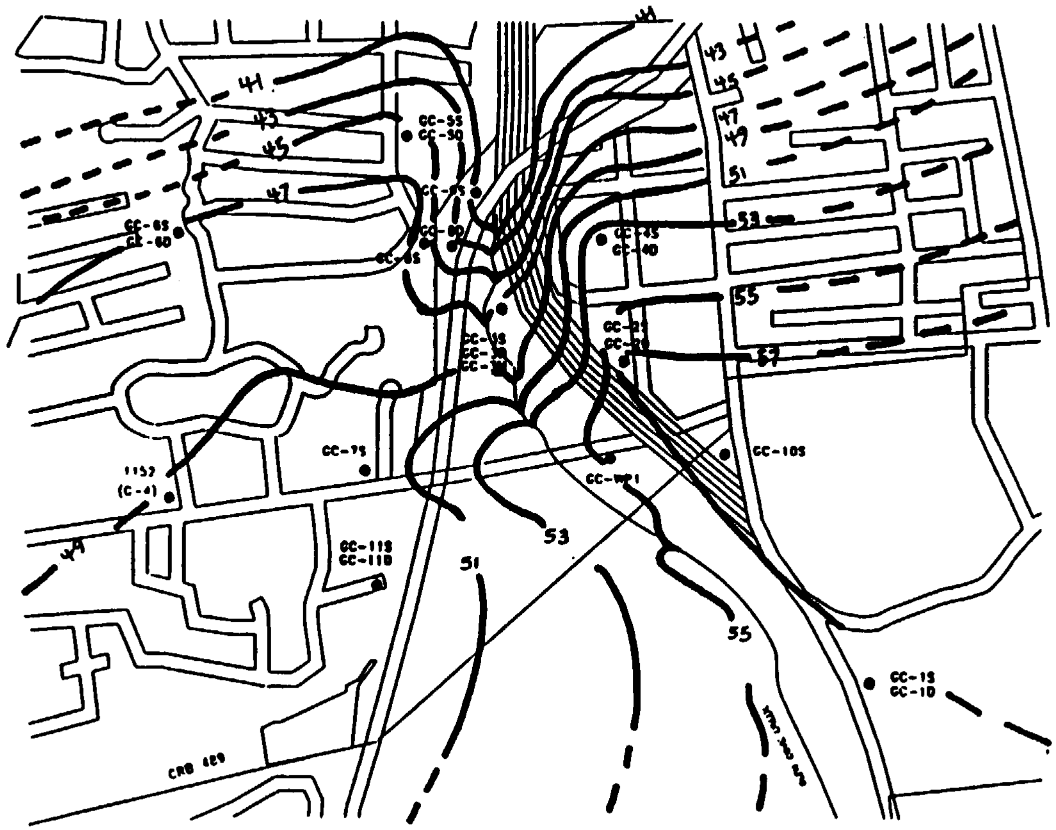
TABLE 3–4

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK

GROUNDWATER LEVELS – FEBRUARY 13, 1990

| WELL | MEASURING POINT ELEVATION (TOP PVC) | ELEVATION TOP SCREEN | ELEVATION BOTTOM SCREEN | DEPTH TO WATER | WATER ELEVATION | VERTICAL GRADIENT |
|---|---|---|---|---|---|---|
| GC–1S | 78.25 | 59.4 | 39.4 | 18.94 | 59.31 | Downward |
| GC–1D | 78.18 | –96.6 | –116.6 | 19.28 | 58.90 | |
| GC–2S | 74.80 | 55.8 | 35.8 | 16.50 | 58.30 | Downward |
| GC–2D | 74.39 | –113.9 | –133.9 | 17.47 | 56.92 | |
| GC–3S | 51.98 | 48.3 | 28.3 | 3.80 | 48.18 | |
| GC–3M | 53.94 | –39.7 | –59.7 | 3.06 | 50.88 | |
| GC–3D | 52.48 | –127.3 | –147.3 | 1.31 | 51.17 | Upward |
| GC–4S | 88.44 | 54.7 | 34.7 | 33.88 | 54.56 | |
| GC–4D | 88.75 | –110.9 | –130.9 | 33.47 | 55.28 | Upward |
| GC–5S | 138.42 | 53.1 | 33.1 | 91.82 | 46.60 | |
| GC–5D | 138.47 | –95.2 | –115.2 | 90.81 | 47.66 | Upward |
| GC–6S | 161.73 | 32.2 | 12.2 | 113.25 | 48.48 | Downward |
| GC–6D | 162.02 | –92.7 | –112.7 | 113.90 | 48.12 | |
| GC–7S | 120.51 | 41.2 | 21.2 | 69.35 | 51.16 | |
| GC–8S | 135.13 | 48.5 | 28.5 | 85.81 | 49.32 | |
| GC–8D | 94.44 | –74.5 | –94.5 | 45.11 | 49.33 | |
| GC–9S | 90.27 | 49.7 | 29.7 | 43.65 | 46.62 | |
| GC–10S | 76.41 | 56.5 | 36.5 | 19.90 | 56.51 | |
| GC–11S | 133.49 | 38.8 | 18.8 | 81.74 | 51.75 | |
| GC–11D | 133.81 | –76.9 | –96.9 | 81.74 | 52.07 | Upward |
| GC–WP1 | 59.98 | 55.0 | 50.0 | 3.04 | 56.94 | |
| G–4 | 153.85 | 28.5 | 23.5 | 103.92 | 49.93 | |
| GLEN COVE CREEK | | | | | | |
| @ Sea Cliff Avenue 59.46 (bench) | | | | 3.95 | 55.51 | |
| @ RR overpass 51.48 (bench) | | | | 10.09 | 41.39 | |
| @ Hendrick 40.83 (bench) | | | | 9.78 | 31.05 | |

All measurements in feet above or below (–) sea level
Elevations surveyed by NCDPW




LEGEND

— 48 — LINE OF EQUAL WATER TABLE ALTITUDE

DISTANCE IN FEET

0 300 600 900 1200

FILE NAME \DVG\GLENHWL

| NO. | REVISION DESCRIPTION | DATE |
|---|---|---|
| 0 | ORIGINAL RELEASE | 4/23/90 |

COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY
HAZARDOUS WASTE SERVICES UNIT

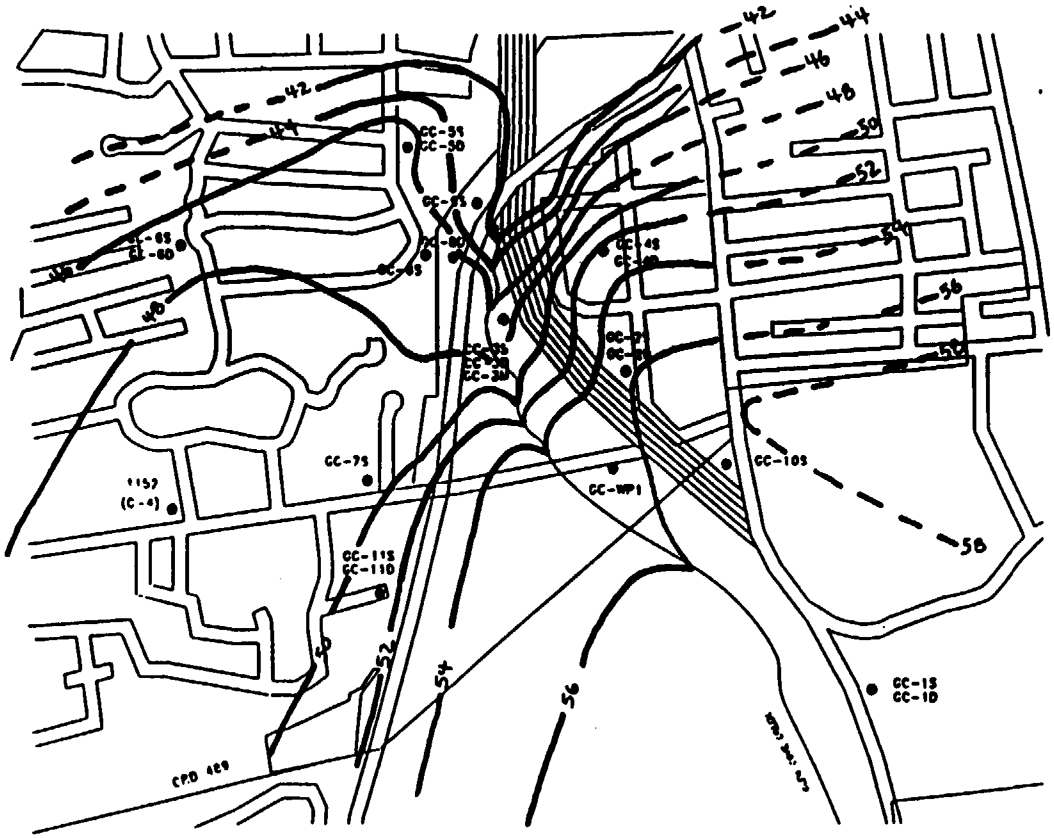
FIGURE 3-7
WATER TABLE
CONFIGURATION 8/22/89

| CONTRACT NUMBER | DWG NO | DRAWN BY | SHEET NO |
|---|---|---|---|
| 50000 | GC-100-01 | J STUMPF 4/10/90 | 1 OF 1 |
| DESIGNED BY | DATE | CHECKED BY | DATE |
| R STORES | 4/5/90 | J DeFRANCO | 4/20/90 |

26-E

103043

65 of 114




LEGEND

—48— LINE OF EQUAL WATER TABLE ALTITUDE

DISTANCE IN FEET

0 300 600 900 1200

| NO | REVISION DESCRIPTION | DATE |
| --- | --- | --- |
| 0 | ORIGINAL RELEASE | [illegible] |

COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY
HAZARDOUS WASTE SERVICES UNIT

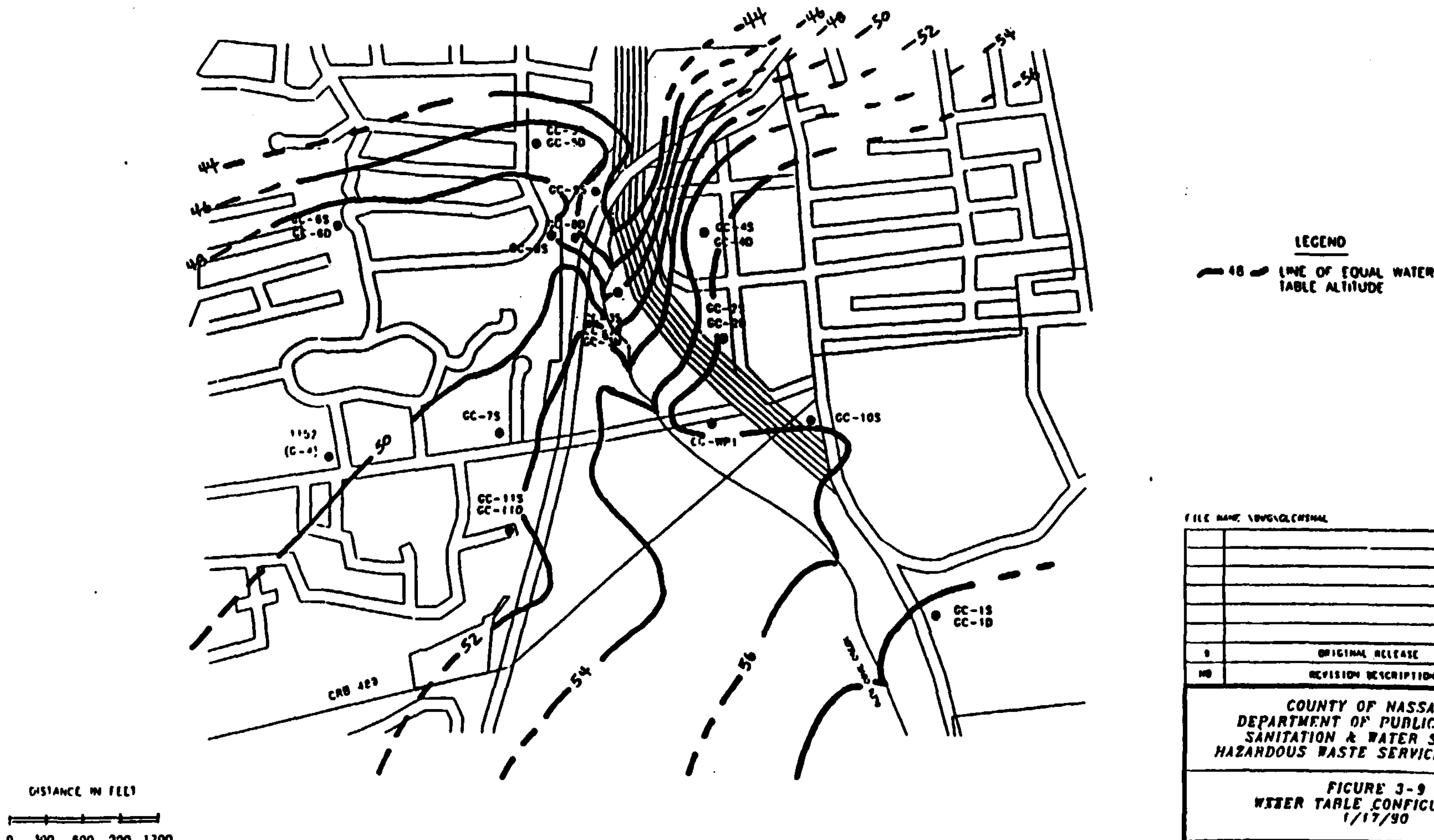
FIGURE 3-A
WATER TABLE CONFIGURATION
9/5/89

| CONTRACT NUMBER | DWG NO | DRAWN BY | SHEET NO |
| --- | --- | --- | --- |
| [illegible] | [illegible] | [illegible] | 1 OF 1 |
| DESIGNED BY | DATE | CHECKED BY | DATE |
| [illegible] | [illegible] | [illegible] | [illegible] |

26-F

103044

103045



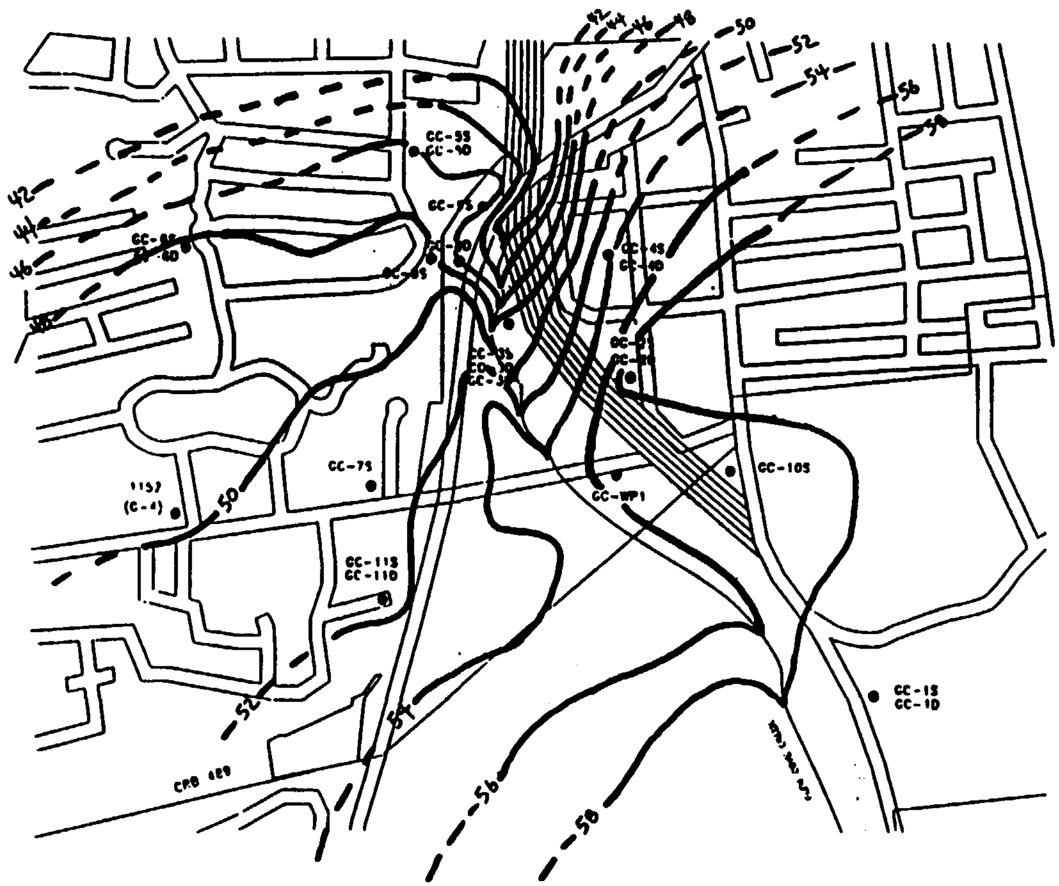

| NO | REVISION DESCRIPTION | DATE |
|---|---|---|
| 0 | ORIGINAL RELEASE | 4/23/90 |

COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY
HAZARDOUS WASTE SERVICES UNIT

FIGURE 3-9
WATER TABLE CONFIGURTAION
1/17/90

| CONTRACT NUMBER | DWG NO | DRAWN BY | SHEET NO |
|---|---|---|---|
| | GC-100-08 | | 1 OF 1 |
| DESIGNED BY | DATE | CHECKED BY | DATE |

26-G




LEGEND

48 LINE OF EQUAL WATER TABLE ALTITUDE

DISTANCE IN FEET

0 100 600 900 1200

FILE NAME \DWG\GLENSHAL

| | | |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| 0 | ORIGINAL RELEASE | 4/23/90 |
| NO | REVISION DESCRIPTION | DATE |

COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY
HAZARDOUS WASTE SERVICES UNIT

FIGURE 3-10
WATER TABLE CONFICURTAION
2/13/90

| CONTRACT NUMBER | DWG NO | DRAWN BY | SHEET NO |
|---|---|---|---|
| [illegible] | CC-100-06 | [illegible] | 1 OF 1 |
| DESIGNED BY | DATE | CHECKED BY | DATE |
| [illegible] | [illegible] | [illegible] | [illegible] |

26-H

103046

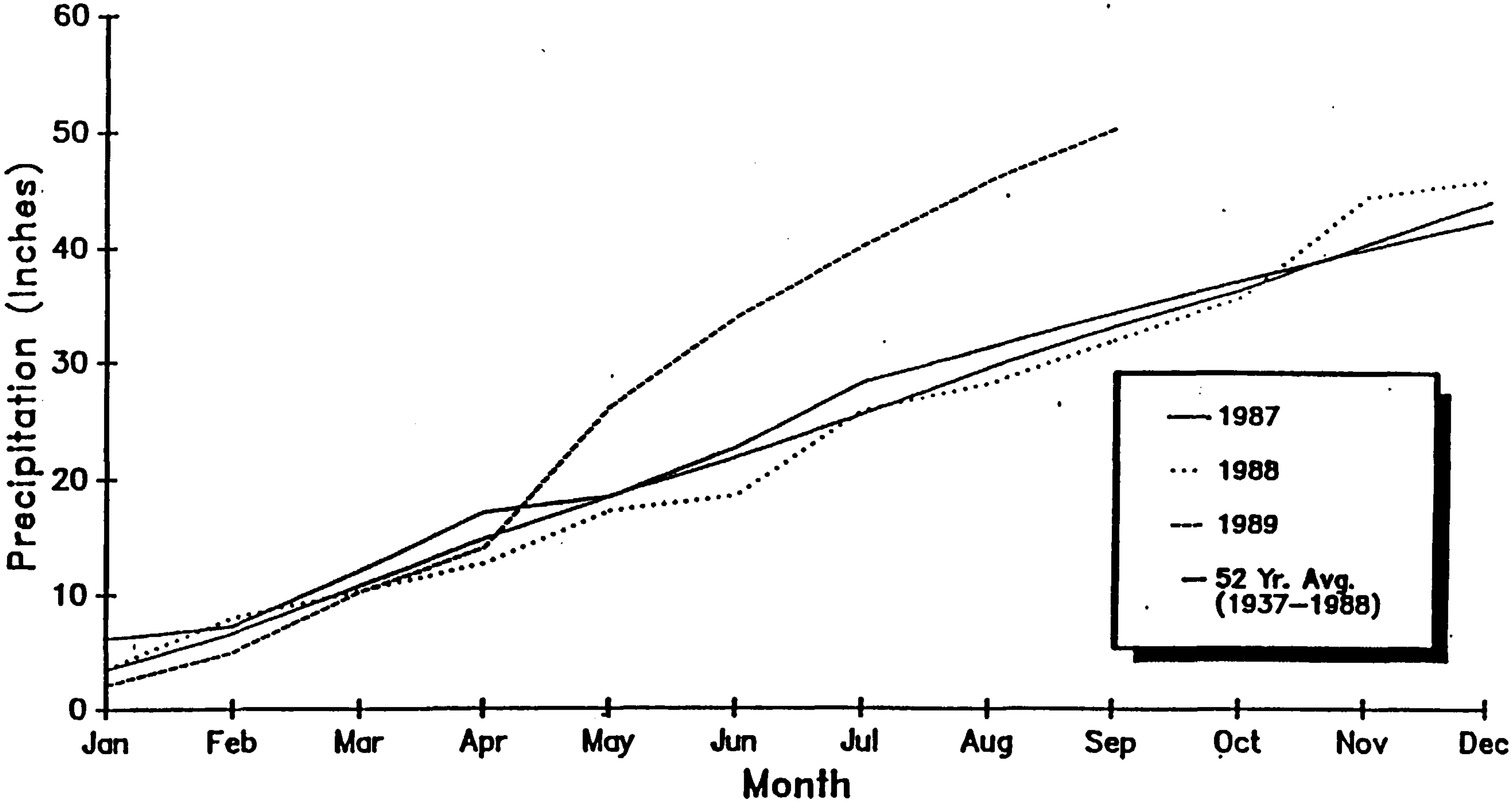
industrial pumpage and diffusion. Figure 3-11 shows the cumulative precipitation for 1988, 1989 and the cumulative 51-year average for the NCDPW, Water Resource Management Unit's Mineola weather station. As shown in this figure, significant above-average precipitation occurred from March to August 1989 (16-inches over average), in comparison to the 51-year cumulative average. This increase in recharge results in higher water table elevations throughout the study area which causes increased gradients and discharge into Glen Cove Creek. Nassau County monitoring well G-4 (1152) showed a water elevation approximately 2 ft. higher in August 1989 than in June 1988.

### 3.2.2 Deep Upper Glacial Aquifer

The deep upper glacial monitoring wells have screen elevations between -75 to -147 ft. bsl depending on the depth to the Port Washington confining unit and their position with respect to existing wells. The deep potentiometric head elevations are shown in Tables 3-1 through 3-4 for each period of water elevation measurement. The deep potentiometric contours are shown in Figures 3-12 through 3-15. The deep contours indicate a consistent west-northwest horizontal flow direction at Sea Cliff Avenue bending to a northwesterly direction northwest of Sea Cliff Avenue.

### 3.2.3 Hydraulic Conductivity

Without a definitive pump test, a range of hydraulic conductivities can be estimated (Morris and Johnson 1967, Driscoll 1986) based upon the sediments logged during well installation. The lower sand and gravel unit, which consists of glacial, reworked glacial and Cretaceous sediment, ranges from a very fine to fine silty sand to a fine to coarse sand with fine gravel. However, the unit can be described as predominantly fine to medium sand. The estimated hydraulic conductivity of the fine to medium sand ranges from 10 to 60 ft./day. The low and high conductivity estimates for the formation range from approximately 5 to 20 ft./day for the fine to silty sand and 100 to 250 ft./day for the fine to coarse sand



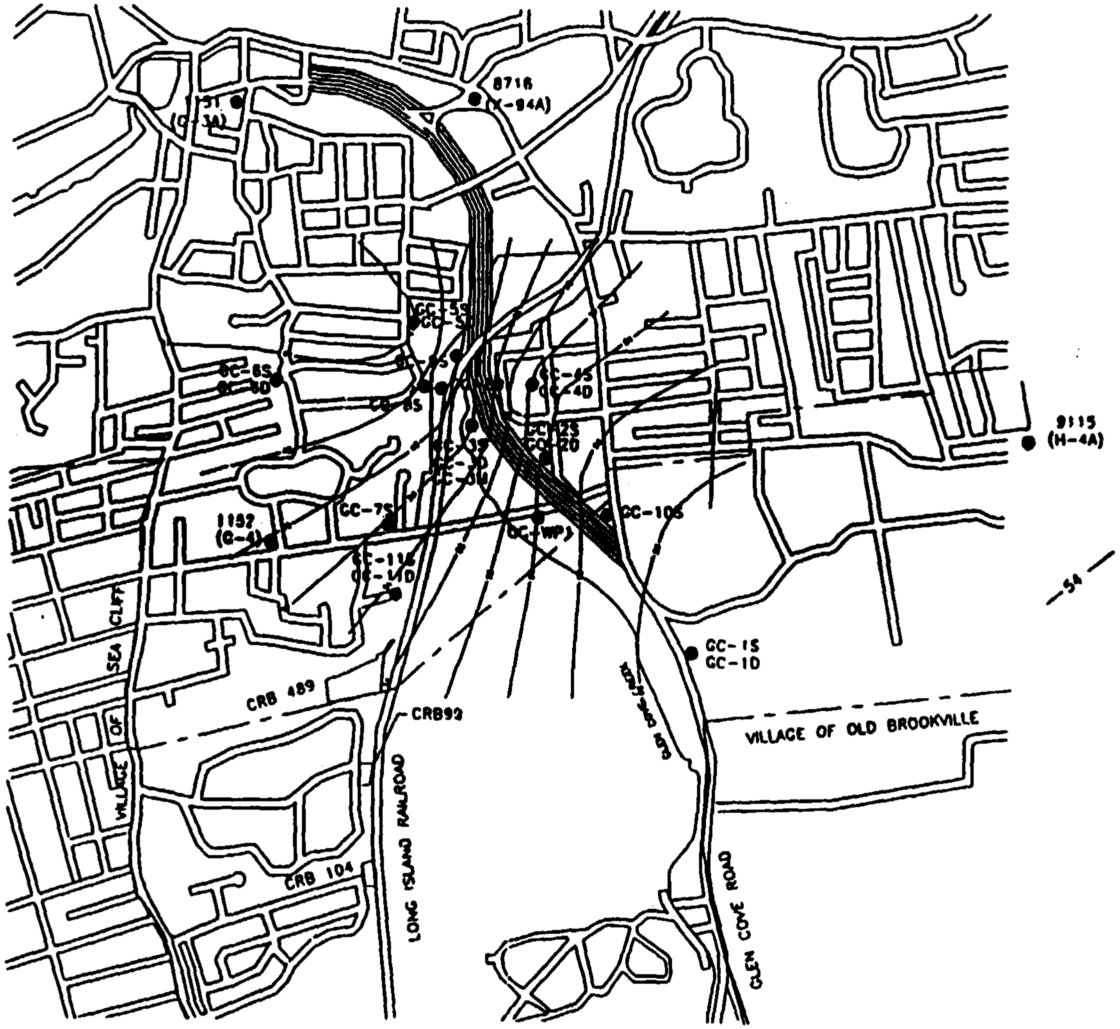

Cumulative Monthly Precipitation
at Mineola Weather Station

FIGURE 3-11

V-27

103048

27-B




LEGEND

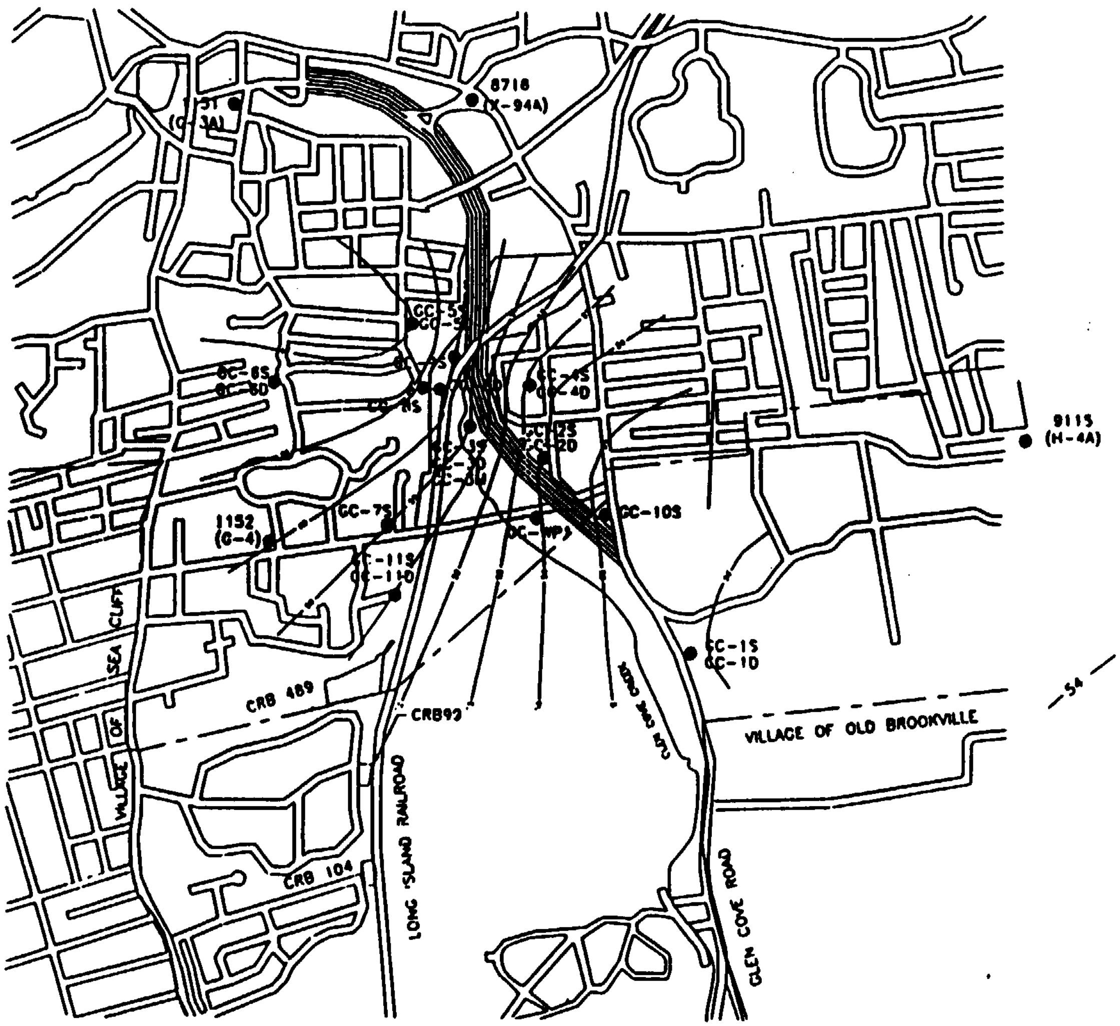
54 LINE OF EQUAL POTENTIOMETRIC ELEVATION

COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY

FIGURE 3-12
DEEP GLACIAL POTENTIOMETRIC CONTOURS 8/22/89

103049

27-C




LEGEND

54 LINE OF EQUAL POTENTIOMETRIC ELEVATION

DISTANCE IN FEET

200 833

0 400 800

| NO. | REVISION DESCRIPTION | DATE |
|---|---|---|
| | | |
| | | |
| | | |
| 0 | FIRST RELEASE | 9/13/89 |
| A | FOR INFORMATION ONLY | 3/22/89 |

COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY

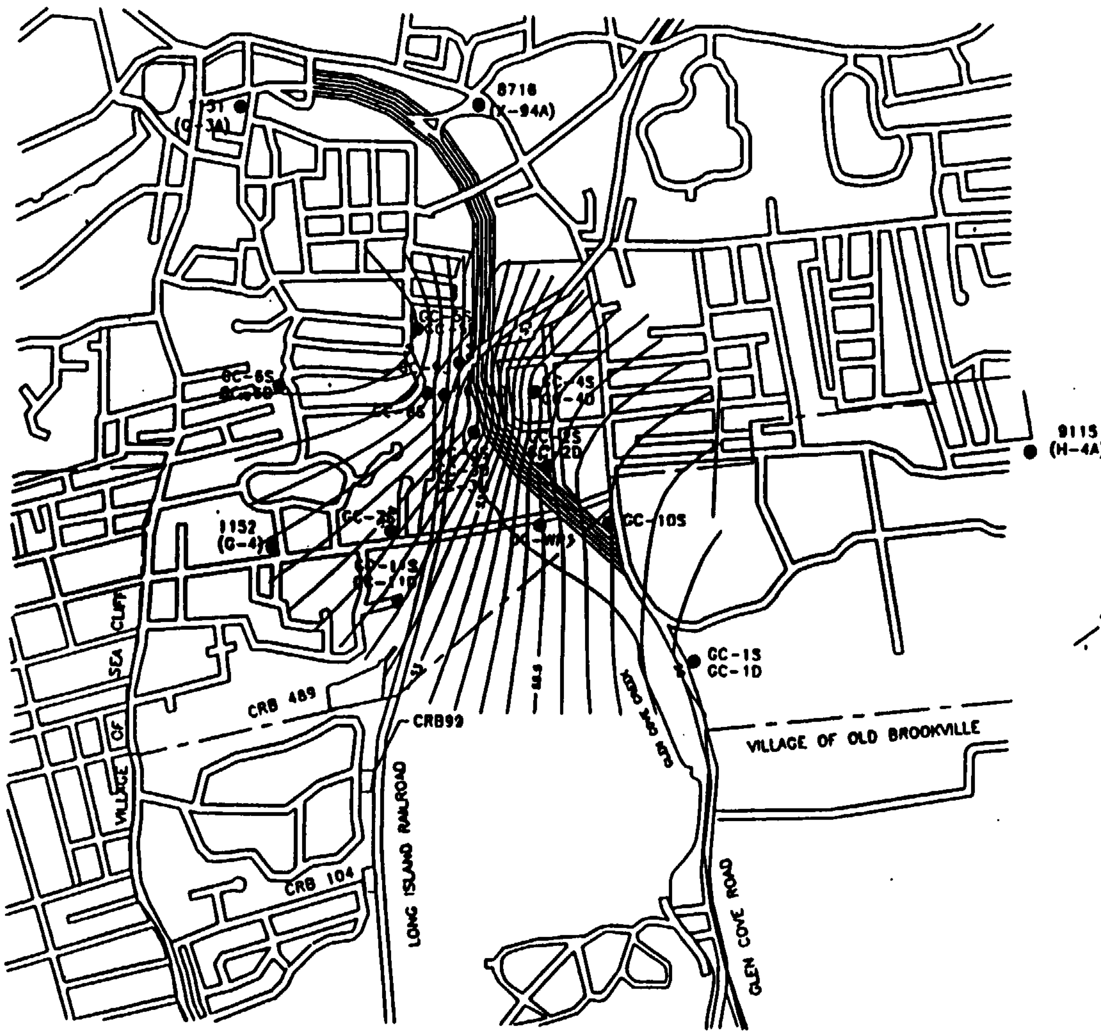
FIGURE 3-13
DEEP GLACIAL POTENTIOMETRIC
CONTOURS 9/5/89

| HAZARDOUS WASTE UNIT | DWG NO | DRAWN BY | SHEET NO |
|---|---|---|---|
| | GC-100-C4 | [illegible] | 1 OF 1 |

103050

72

8/14




DISTANCE IN FEET

LEGEND

LINE OF EQUAL POTENTIOMETRIC ELEVATION

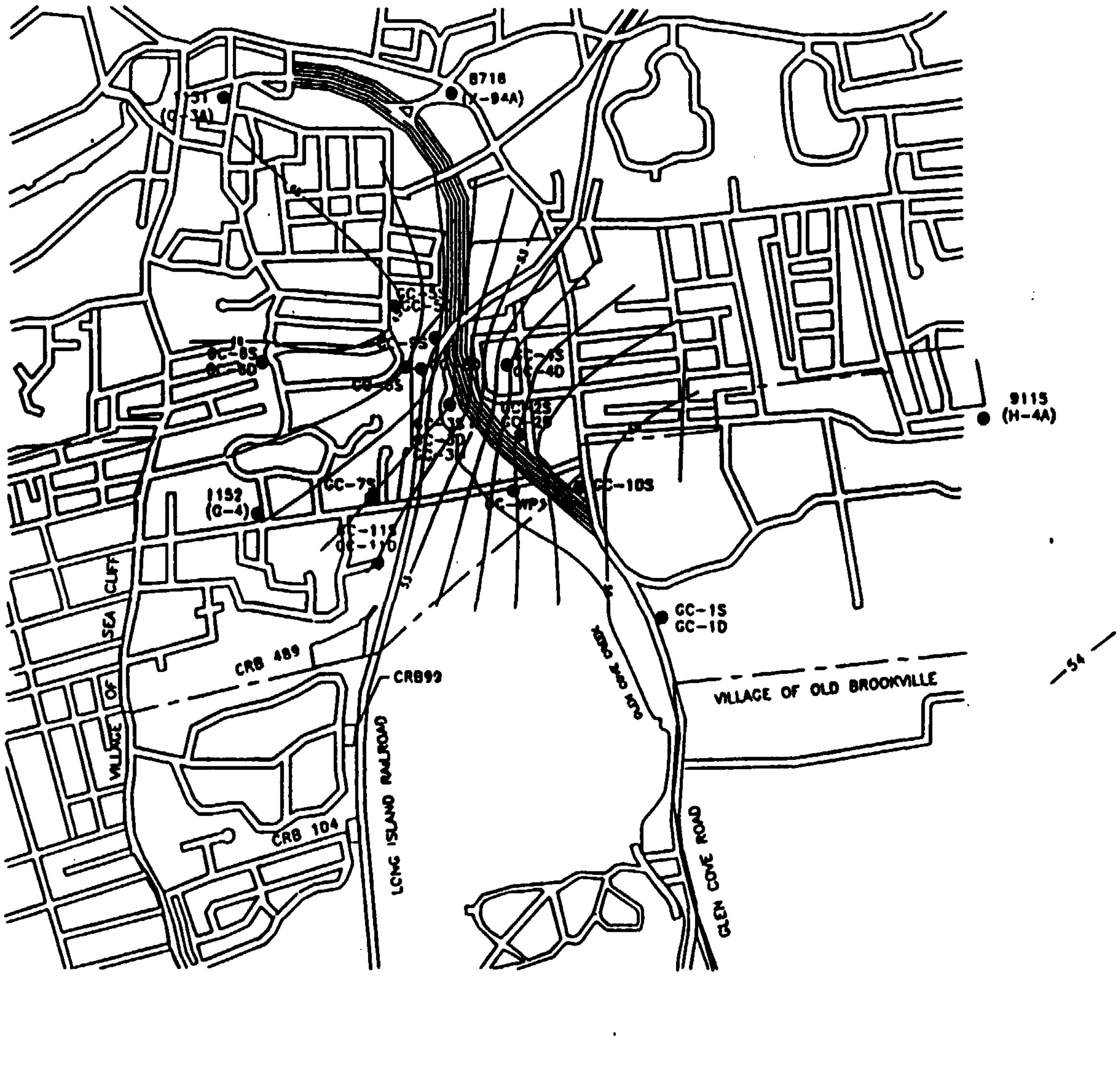
COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY

FIGURE 3-14
DEEP GLACIAL POTENTIOMETRIC CONTOURS 1/17/90

| NO. | REVISION DESCRIPTION | DATE |
|---|---|---|
| A | FOR INFORMATION ONLY | |

| HAZARDOUS WASTE UNIT | DOC NO | DRAWN BY | SHEET NO |
|---|---|---|---|
| | | | 1 OF 1 |

103051




| NO. | REVISION DESCRIPTION | DATE |
|---|---|---|
| A | FOR INFORMATION ONLY | 3/22/91 |

COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY

FIGURE 3-15
DEEP GLACIAL POTENTIOMETRIC CONTOURS 2/13/90

| HAZARDOUS WASTE UNIT | DWG NO | DRAWN BY | SHEET NO |
|---|---|---|---|
| | | 1/11/91 | 1 OF 1 |

27-E

103052

117 of 77

with fine gravel. As discussed earlier, two till facies were logged, a sandy facies and a silty clayey facies. Due to their poor sorting and heterogeneous nature, both facies represent low hydraulic conductivity formations. The estimated range of conductivity for the silty clayey facies logged at wells GC-2, 3, 4, 6, 8, 9, 10 and 11 is from 0.01 to 1 ft./day. The sandy facies range is estimated to be from 1 up to 100 ft./day in well-washed areas. Previous estimates of the ratio of the horizontal to vertical conductivity, due to the anisotropic nature of the primarily horizontally bedded sediments, range from 5:1 to 24:1 in the upper glacial aquifer (Lindner and Reilly 1983).

$50 \frac{ft}{day} \cdot \frac{30.48\,cm}{1\,ft} \cdot \frac{1\,day}{86400\,sec} = 0.0176\,cm/sec$

### 3.2.4 Vertical Gradients

Vertical groundwater gradients and flow components can be quantified by comparing the synoptic differences in the hydrostatic heads at the well clusters. Well clusters 1, 2, and 6 (Fig. 2-1) have shown consistent downward vertical gradients. Of note is the high downward vertical gradient (0.015 ft./ft., August 1989) at well cluster 2, adjacent to the Sea Cliff Avenue industrial zone. During the summer of 1989, well clusters GC-4 and 5 have shown a general horizontal or slightly downward gradient, shifting to an upward vertical gradient in February 1990. This fluctuation may reflect the seasonal variation in industrial and air conditioning pumpage from high summer pumpage (indicated by the slight downward vertical gradient) to the low or non-pumpage conditions in the mid-winter. Well cluster GC-8 has indicated near horizontal flow during two periods of measurement taken in mid-winter. Well cluster GC-11 has shown an upward vertical gradient during two periods of measurement taken in mid-winter. Well cluster GC-3, located at the Carney Street well field and immediately adjacent to Glen Cove Creek, has shown a consistently upward vertical gradient (range 0.012 to 0.015 ft./ft.) from the summer of 1989 through the winter of 1990. The upward vertical gradient is apparently due to the higher consistent deep glacial potentiometric heads relative to the lower water table heads at, and adjacent to, Glen Cove Creek during base flow discharge periods. This difference in heads is created by rapid local changes in surface topography.

Generally, vertical gradients at the well clusters indicate downward components of flow during the summer pumpage season. Measured vertical gradients during the winter of 1990 compared to the summer of 1989, however, have shown a reversal from slightly downward or near horizontal to upward vertical flow at well clusters GC-4 and 5 and a steady upward component at GC-11, probably reflecting mid winter low industrial pumpage conditions. The exception is the consistent upward vertical gradient exhibited at well cluster GC-3 immediately adjacent to Glen Cove Creek. The effects of industrial pumpage on the aquifer is discussed further in the following section.

### 3.2.5 Industrial Pumpage

Photocircuits Corporation, Slater Electric and the Pall Corporation have water supply wells for industrial cooling and air conditioning purposes. All three companies discharge the water on-site through diffusion wells (see Table 1-5 for pumpage rates). This pumpage will cause localized increased vertical gradients at the wellhead, localized reversals of normal horizontal gradients during pumpage cycles and groundwater mounding at the diffusion wells. Additionally, there may be overlapping cones of influence when two or more pumps are operating simultaneously. Pending the lack of on-site quantitative data, a Stevens Water Level Recorder was installed at well GC-3D, the closest deep monitoring well not subject to vandalism and adjacent to the Sea Cliff Avenue industrial zone, to help assess the industrial pumpage effects on the aquifer. Wells 2316 (Pall Corp.), 8887 and 9612 (Slater Electric), and 7427 and 8224 (Photocircuits Corp.) are approximately 900, 1,400 and 1,650 ft., respectively, from well GC-3D (refer to Figure 1-9).

A hydrograph of well GC-3D was completed from mid September 1989 to early

January 1990 and is enclosed in Appendix F. Consistent pumping effects (cycles of drawdown and recovery) can be seen from October 3 through October 19, 1989. Based upon the hydrograph there are AM and PM pump cycles starting and ending at approximately 6:00 - 11:00 AM and 5:00 - 10:00 PM, respectively. The AM pump cycle shows a greater water level deflection (up to 0.39 ft.) indicating higher pumping rates. Thus, the cone(s) of influence of either the closest well (2316) or the combined effects of 2316 and additional wells in the area extend outward a minimum of 900 ft. from the wellhead(s). Additionally, the pumping effects extend to the base of the upper glacial aquifer and apparently have a measurable effect on the vertical gradients at well clusters GC-4 and 5. Prior to October 3rd, the hydrograph apparently shows the superimposed drawdown of both the industrial and air conditioning wells. This is shown by the overall lower water level, less water level deflection and slight water level perturbations, as no consistent pump cycle is established. Erratic pumping cycles were recorded from October 19 until approximately January 1990, when pumpage effects were no longer detected. Due to a lack of site specific data, a limited amount of data from well GC-3D's hydrograph and the inherent hydrodynamic complexities involved with the volume of industrial pumpage occurring during the demand seasons (up to 1.9 million gpd total pumpage), further in-depth study is warranted to more thoroughly establish the relationship between the aquifer, pumpage rates and contaminant transport.

### 3.3 Groundwater Quality

Tables 3-5 and 3-6 are summaries of the Phase One and Phase Two volatile organic analyses for each well. Additionally, Glen Cove Creek was analyzed for VOC's during base flow periods as summarized in Tables 3-7 and 3-8. Throughout the sampling period tetrachloroethylene was the VOC compound detected at the highest concentration (range 2 to 3700 ug/L). Trichloroethylene was detected ranging from 1 to 500 ug/L. Low levels of 1,1,1-Trichloroethane were also detected. Other

## TABLE 3-5

### INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
### CITY OF GLEN COVE
### NASSAU COUNTY, NEW YORK
### VOLATILE ORGANIC ANALYSIS SUMMARY - PHASE I

| Well Number<br>Number of Samples | GC-2S<br>1 | GC-3S<br>1 | GC-5S<br>1 | GC-5D<br>1 | GC-6D<br>1 | GC-7S<br>1 | G-4*<br>1 |
|---|---|---|---|---|---|---|---|
| 1,1-Dichloroethane | | 8 | | 1 | | 2 | |
| 1,1-Dichloroethylene | | 4 | 3 | 2 | | 4 | |
| c-1,2-Dichloroethylene | | 1,300 | | 14 | | 3 | 2 |
| t-1,2-Dichloroethylene | | 4 | | | | | |
| 1,1,1-Trichloroethane | 2 | 3 | 1 | 3 | | 37 | 1 |
| Tetrachloroethylene | | 3,700 | 74 | 2 | | 340 | 57 |
| Trichloroethylene | 2 | 500 | 9 | 25 | | 5 | 2 |
| Vinyl Chloride | | | | 1 | 5 | | |

All results in ug/l

* Existing NCDPW Well G-4, N-1152

## TABLE 3-6

### INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
### CITY OF GLEN COVE
### NASSAU COUNTY, NEW YORK
### VOLATILE ORGANIC ANALYSIS SUMMARY - PHASE II

| Well Number | GC-2S | GC-2D | GC-3S | GC-3M | G-4* | GC-4S | GC-4D | GC-5S | GC-5D | GC-6S | GC-6D | GC-7S | GC-8S | GC-8D | GC-9S | GC-10S | GC-11S | GC-11D | GC-WP1 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Number of Samples | 1 | 2 | 3 | 2 | 1 | 1 | 2 | 1 | 1 | 1 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 2 | 1 |
| Chloroform | 1 | | ND-3 | 2-3 | | | | | | | | 1 | ND-1 | 4-5 | | 1-5 | | | |
| 1,1-Dichloroethane | | ND-5 | 10-12 | 7-9 | | | 1-3 | | 2 | | | 2 | | 9-10 | 1-2 | 6-7 | | | 2 |
| 1,2-Dichloroethane | | ND-3 | ND-1 | 2-2 | | | | 6 | 33 | | | | | | | | | | |
| 1,1-Dichloroethylene | | 10-16 | 8-19 | 3-5 | | | 4-9 | | 3 | | 1-2 | 9 | | 4-4 | 1-1 | 3-5 | | | |
| c-1,2-Dichloroethylene | 1 | | 160-320 | 140-260 | 1 | | | 2 | 34 | | | 10 | | 120-150 | 35-36 | 49-67 | | | 14 |
| t-1,2-Dichloroethylene | | | 1-2 | 1-2 | | | | | | | | | | 1-1 | | | | | |
| 1,2-Dichloropropane | | | 3-5 | | | | | | | | | | | | | | | | 3 |
| Methylene Chloride | | | | | | | | | | | | | | | | | | 1-1 | |
| 1,1,2,2-Tetrachloroethane | | | ND-1 | | | | | | | | | | | | | | | | |
| Tetrachloroethylene | 1 | | 1,300-2,500 | 25-34 | 17 | 2 | | 45 | 4 | 1 | | 500 | 4-6 | 10-14 | 12-13 | 6-8 | ND-1 | ND-2 | 1 |
| Toluene | | | ND-4 | ND-4 | | | | 5 | | | | 1 | ND-4 | | | | | 1-1 | 4 |
| 1,1,1-Trichloroethane | 5 | 50-440 | 11-18 | 3-8 | 1 | 1 | 34-150 | 6 | 3 | 1 | 9-13 | 45 | ND-4 | 5-6 | 1-1 | 15-19 | | | 5 |
| 1,1,2-Trichloroethane | | | | ND-1 | | | | | | | | | | | | | | | |
| Trichloroethylene | 3 | ND-1 | 110-210 | 210-370 | 1 | | | | | | | 8 | 1-1 | 87-110 | 19-27 | 41-44 | | 1-1 | |
| Trichlorofluromethane | | 2-19 | 14-40 | | | | ND-2 | | | | | | | | | | | | |
| Vinyl Chloride | | | ND-6 | ND-1 | | | | | | | 1-2 | | | 3-3 | | | | 1-4 | 1 |

All results in ug/l

ND = Not Detected

(-) = Range (low and high result)

* Existing NCDPW Well G-4 (1152)

TABLE 3-7

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK

VOLATILE ORGANIC CHEMICAL SUMMARY *

GLEN COVE CREEK, AUGUST 2, 1989

| COMPOUND | AT GLEN HEAD COUNTRY CLUB | AT SEA CLIFF AVENUE | AT CARNEY STREET WELL FIELD | AT ARTERIAL HIGHWAY RAILROAD OVERPASS |
|---|---|---|---|---|
| 1,1-Dichloroethylene ** | N.D. | 1 | 21 | N.A. |
| 1,1-Dichloroethane | N.D. | 10 | 3 | N.A. |
| Trichloroethylene ** | N.D. | 48 | 19 | N.A. |
| Tetrachloroethylene ** | N.D. | 3 | 18 | N.A. |

All results in ug/l
N.D. – Not Detected
N.A. – Not Analyzed
* Analysis by NCDPW Cedar Creek Laboratory
** All 'ethylene' compounds reported by laboratory as 'ethene'

TABLE 3-8

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK

VOLATILE ORGANIC CHEMICAL SUMMARY *

GLEN COVE CREEK, SEPTEMBER 6, 1989

| COMPOUND | AT GLEN HEAD COUNTRY CLUB | AT SEA CLIFF AVENUE | AT CARNEY STREET WELL FIELD | AT ARTERIAL HIGHWAY RAILROAD OVERPASS |
|---|---|---|---|---|
| 1,1-Dichloroethylene ** | N.A. | N.D. | 9 | 19 |
| 1,1-Dichloroethane | N.A. | N.D. | 1 | 1 |
| 1,1,1-Trichloroethane | N.A. | 3 | N.D. | 5 |
| Trichloroethylene ** | N.A. | N.D. | 7 | 63 |
| Tetrachloroethylene ** | N.A. | N.D. | 16 | 29 |

All results in ug/l
N.D. – Not Detected
N.A. – Not Analyzed
* Analysis by NCDPW Cedar Creek Laboratory
** All 'ethylene' compounds reported by laboratory as 'ethene'

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chlorinated compounds detected, most notably cis-1,2-dichloroethylene, 1,1-dichloroethane and vinyl chloride, represent potential breakdown compounds from tetrachloroethylene and/or trichloroethylene. Samples from wells GC-3S, 7S, 8D and G-4 were split during Phase Two with NYSDEC-certified Weston Laboratory of Lionville, Pennsylvania, confirming the types and levels of compounds present (see Appendix E). Inorganic analyses were primarily performed to determine if potential metal plating industrial effluent had affected the aquifer. A review of the inorganic water quality has shown lead and manganese above NYSDEC Class GA groundwater standards (NYSDEC Water Quality Regulations, Title 6, Chapter X, Part 703.5) at wells GC-3S and 8S. Manganese was above these standards at wells GC-9S and 10S. As previously discussed well GC-10S is adjacent to the Photocircuit Corporation's diffusion wells and wells GC-3S, 8S and 9S are downgradient of the Sea Cliff Avenue industrial zone. Metal samples were not field filtered and results represent total amounts. Please refer to Appendix E for the full laboratory results.

### 3.3.1 Shallow Groundwater Quality

Evaluation of the lithologic data obtained during the drilling portion of the investigation, in conjunction with a knowledge of existing monitoring well constructions, allowed for optimal placement of the shallow groundwater monitoring well screens (see Figure 3-16). The bottom screen elevations for each of the shallow wells were set at comparable intervals to maximize the correlation of groundwater quality data. Since existing monitoring well G-4 had exhibited volatile organic levels up to 190 ug/L in previous sampling rounds, its screen setting of approximately 30 ft. into the water table was used for new wells GC-7S and 11S (see Figure 2-1).

Because the contamination extends a minimum of thirty feet into the water table at well G-4 approximately 2,000 ft. west of the industrial zone, it is

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possible to evaluate the presence and movement of volatile organic chemical contamination in this segment of the aquifer in terms of the local geology. The sediments at the shallow saturated zone in this area are predominantly moderate to poorly sorted fine to medium grained sand with gravel featuring a generally clean matrix. Although featuring areas of poor sorting, these sediments will have a greater hydraulic conductivity than the silty till identified east of the creek, creating a preferred groundwater flow pathway.

Shallow groundwater flow and quality can be described by contouring total VOC levels in ug/L (see Figure 3-16). As shown in the figure, there is a bifurcating VOC plume originating from the industrial zone along Sea Cliff Avenue. The southern fork of the plume is moving with the existing shallow groundwater gradient south of Sea Cliff Avenue through the more permeable sediments in a westerly direction. Total VOC levels in this portion of the plume range up to 576 ug/L. The primary volatile organic compound is tetrachloroethylene (PCE) with low levels of 1,1,1-trichloroethane. The apparent western boundary of this segment of the plume extends west of well G-4. Public water supply well 7857 (Sea Cliff Water Company), screened in the Lloyd aquifer, is approximately 3,800 ft. west of well G-4. Well GC-11S reported only 1 ug/L of PCE delineating the southern boundary of the shallow plume.

The northern plume extension moves with the creek-influenced gradient and northerly flow direction extending beyond well GC-5S. Trace levels of contamination have been detected at well GC-6S where the water table is in the upper till unit (refer to Hydrogeology, section 3-2). The highest total VOC levels (ranging from 1,700 to 5,500 ug/L) were recorded at well GC-3S immediately downgradient of the Sea Cliff Avenue industrial zone. The groundwater contours east of the creek direct the plume towards well GC-3S. The primary volatile organic chemical identified at well GC-3S is tetrachloroethylene. Other primary

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volatiles at GC-3S and further downgradient (wells GC-5S and 9S), include trichloroethylene and cis-1,2-dichloroethylene. Total water table VOC levels drop off to 78 ug/L at well GC-9S and to 60 ug/L at well GC-5S, 750 and 1,150 ft. downgradient from well GC-3S, respectively. The water table is in the silty till at well GC-3S immediately downgradient of the industrial zone, the lower sand formation at well GC-5S and the predominantly silty till at well GC-9S (see Figure 3-4). Wells monitoring the north plume extension generally have screens set approximately 18-19 ft. into the water table.

Well GC-10S, located south of Sea Cliff Avenue and immediately east of the industrial zone, reported 152 ug/L total VOC's. Primary volatiles identified include cis-1,2-dichloroethylene, trichloroethylene and 1,1,1-trichloroethane. It should be noted that these volatiles are the primary volatiles historically quantified in recent sampling of industrial supply wells at Photocircuits, Pall Corporation and Slater Electric (see Table 1-3). Additionally, elevated specific conductance and temperature levels were recorded during sampling. Photocircuits Corporation has two diffusion wells immediately to the west of well GC-10S (see Figure 1-9). Therefore, it is possible that the diffusion wells have extended the plume in an easterly direction as shown in Figure 3-16.

Sampling of Glen Cove Creek during base flow discharge periods can be used to indicate shallow water table quality, although there will be a loss of organic compounds to volatilization associated with surface water. Sampling completed on August 2, 1989 showed no detectable contamination at Glen Head Country Club (upgradient), 62 ug/L total VOC at Sea Cliff Avenue and 61 ug/L total VOC at Carney Street. Sampling completed on September 6, 1989 reported 3, 33 and 117 ug/L total VOC in Glen Cove Creek at Sea Cliff Avenue, Carney Street, and at the Arterial Highway railroad overpass, respectively. Previous sampling of Glen Cove Creek by the NCDH has never detected VOC's at the Glen Head Country Club. This data, in

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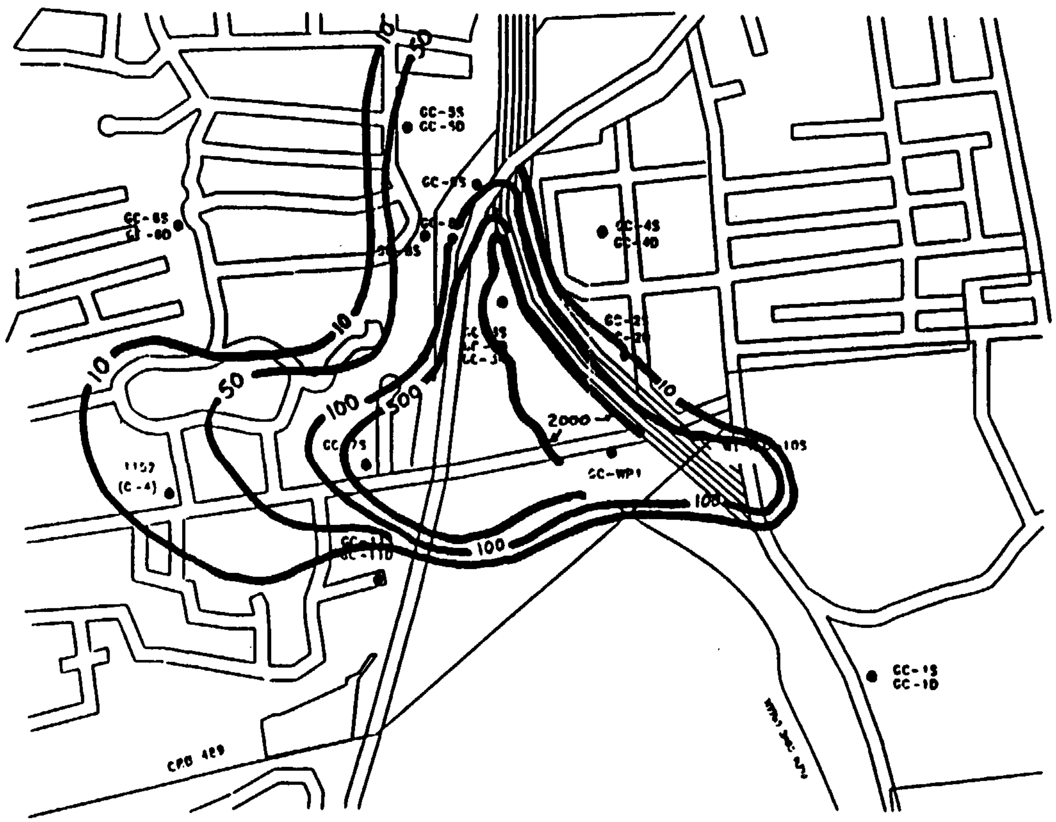


LEGEND

500 LINE OF EQUAL TOTAL VOC CONCENTRATION IN PPB

DISTANCE IN FEET

0 300 600 900 1200

| NO | REVISION DESCRIPTION | DATE |
|---|---|---|
| 0 | ORIGINAL RELEASE | [illegible] |

COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY
HAZARDOUS WASTE SERVICES UNIT

FIGURE 3-16
WATER TABLE
GROUNDWATER QUALITY

| CONTRACT NUMBER | DOC NO | DRAWN BY | SHEET NO |
|---|---|---|---|
| [illegible] | [illegible] | [illegible] | 1 OF 1 |
| DESIGNED BY | DATE | CHECKED BY | DATE |
| [illegible] | [illegible] | [illegible] | [illegible] |

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conjunction with the water quality at well GC-10S, indicates a source area of VOC's somewhere north of the Glen Head Country Club, possibly due to industrial water diffusion or a surface point source.

3.3.2 Deep Glacial Water Quality

As with the shallow glacial zone, deep glacial water quality, potentiometric flow and contaminant transport can be contoured and evaluated relative to local geology and stratigraphy. Total VOC levels are contoured in ug/L as shown in Figures 3-17 and 3-18. Pending the lack of a deep monitoring well at Sea Cliff Avenue, the historical water quality of the Pall Corporation, Slater Electric and Photocircuits wells can be utilized to provide information on deep glacial groundwater quality. Analysis of this data indicates that there is a low level plume of VOC's emanating from the Sea Cliff Avenue industrial zone, moving northwest with the groundwater flow through the lower sand and gravel formation to a depth of approximately -115 ft. below sea level. Public Water supply well 9334 (City of Glen Cove - Kelly Street well), screened from - 100 to -150 ft. bsl, is approximately 1,300 ft. northeast of well GC-4D (see Figures 1-9 and 2-1). The primary VOC's identified include trichloroethylene, cis-1,2-dichloroethylene, and tetrachloroethylene. Of note is the sporadic detection of 1,1,1-trichloroethane at wells GC-2D, 4D and 6D, all of which are screened at the base of the aquifer. This may be due to a combination of industrial usage/discharge and residential cesspool and drain cleaners (Kilburn and Krulikas, USGS, 1987).

3.3.3 Contaminant Dispersion and Hydrodynamics

Figure 3-18 is a January 1990 hydrogeologic water quality cross-section running south to north through the study area. Wells 7427, 8224, 8930 and 10107 have been projected onto the section due to their close proximity to the section line (see Table 1.9 for the full listing of industrial supply and diffusion wells). Water quality for diffusion well 8930 was supplied by the NYSDEC and is enclosed in


LEGEND

100 LINE OF EQUAL TOTAL VOC CONCENTRATION IN PPB

DISTANCE IN FEET

0 300 600 900 1200

FILE NAME: [illegible]

| NO. | REVISION DESCRIPTION | DATE |
|---|---|---|
| 0 | ORIGINAL RELEASE | 4/23/90 |

COUNTY OF NASSAU
DEPARTMENT OF PUBLIC WORKS
SANITATION & WATER SUPPLY
HAZARDOUS WASTE SERVICES UNIT

FIGURE 3-17
DEEP GLACIAL
GROUNDWATER QUALITY

| CONTRACT NUMBER | DWG NO | DRAWN BY | SHEET NO |
|---|---|---|---|
| [illegible] | [illegible] | [illegible] | 1 OF 1 |
| DESIGNED BY | DATE | CHECKED BY | DATE |
| [illegible] | [illegible] | [illegible] | [illegible] |

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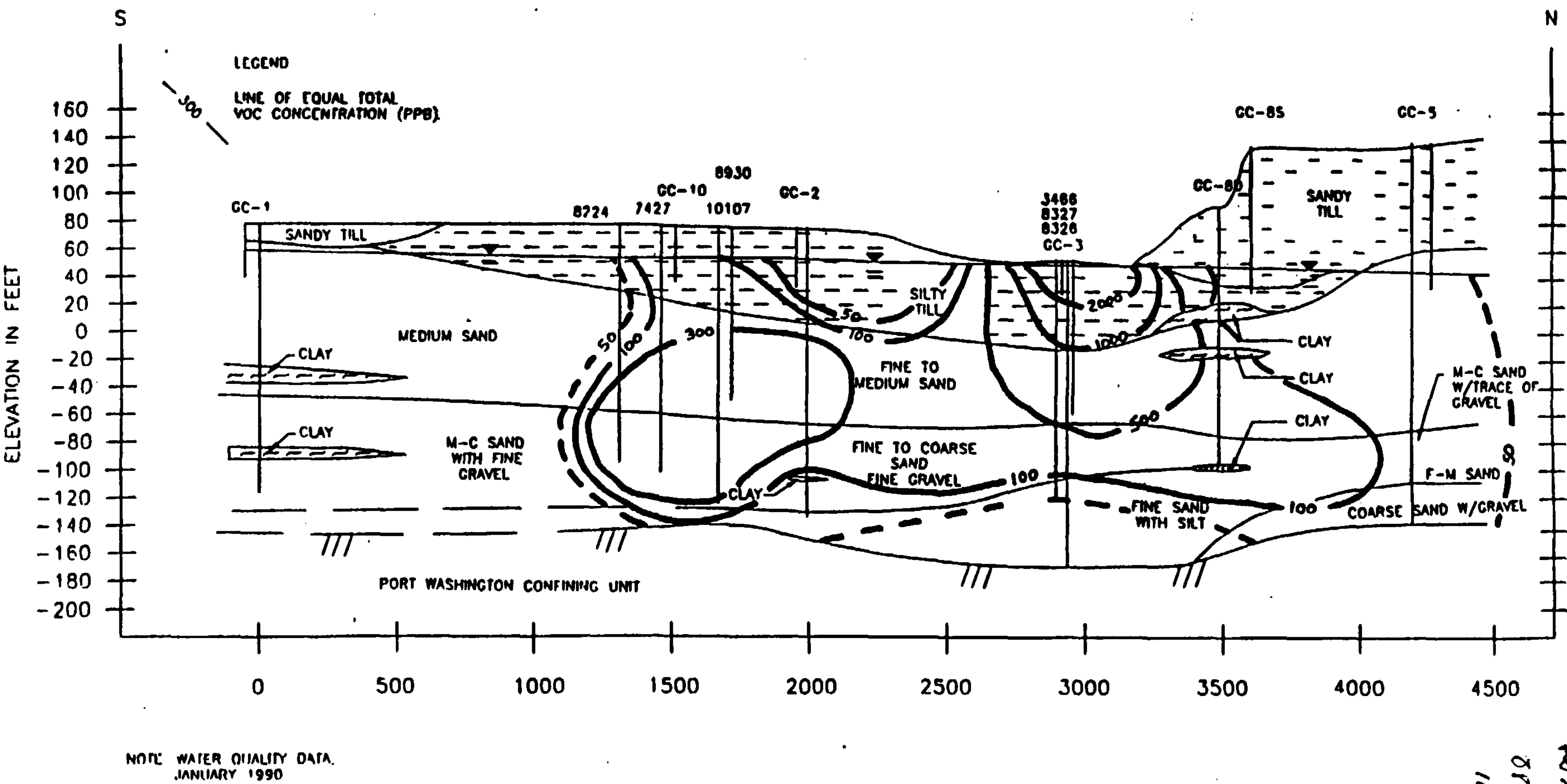
# FIGURE 3-18
# WATER QUALITY CROSS SECTION
# WELLS GC-1 THRU GC-8




34-B

103066

Appendix E.

As shown in Figure 3-18, and as discussed previously, there is an upper water table plume and a lower deep glacial plume. The water table plume, located in the low permeability upper till, is moving downgradient with the groundwater flow through advection. Over time, through advection and an increase in vertical groundwater gradients due to pumpage, contamination has probably breached the contact between the till and the lower sand formation, migrated downward for intake into the deep supply well screens, and was eventually reintroduced back into the aquifer through the industrial diffusion wells. An important factor affecting contaminant transport is the strong upward vertical groundwater gradient at the Carney Street monitoring well cluster (wells GC-3S, 3M and 3D), which effectively limits contamination to the mid and water table levels of the aquifer at Carney Street. It should be noted, however, that a review of the NYSDEC well construction reports completed for Carney Street well 3466 did not show the outer casing to be grouted to depth (please refer to Appendix B). The potential for water table contaminants to migrate vertically down the borehole to the deep well screen during pumpage existed. This could result in non-representative water quality samples.

Therefore, a likely contaminant transport scenario would involve localized water table contamination and downgradient advection at the Sea Cliff Avenue industrial zone, the vertical migration of contaminants caused by pre-1977 Carney Street Supply well pumpage (up to 4.7 million gpd) and industrial well pumpage, and the eventual dispersion of contamination throughout the aquifer caused by the use of diffusion wells screened at different elevations. As discussed in the industrial pumpage section (3.2.5), a mid-winter non to low pumpage condition would allow downgradient migration of the contamination to an area outside the effective radius of influence of the industrial supply wells during the pumpage season. Contamination has migrated to a depth of -115 ft. bsl approximately 2,400 ft. to the northwest of the Sea Cliff Avenue industrial zone at well GC-5D. Water level data indicates that there are reversals of vertical gradients from near horizontal or slightly downward to upward at certain well clusters between the heavy summer pumpage season and the non to low winter pumpage. However, these effects need to be more thoroughly quantified through additional study.

As shown in Figure 3-17, the isoconcentration lines of the deep plume are slightly oblique to the true flow direction (perpendicular to the potentiometric contours). This discrepancy is most likely due to a limited number of monitoring wells in relation to the large volume of industrial pumpage (up to 1.9 million gpd) during the demand season.

### 3.4 Possible Sources

Although site-specific data acquisition from private property was beyond the scope of this study, the data which was complied during the course of this investigation could indicate potential source areas. As presented in Table 1-4, eight companies reported the use of organic chemicals through the industrial chemical profile. The Pall Corporation, Photocircuits Corporation and Slater Electric are companies reporting the historic use of significant quantities of volatile organic chemicals. Additionally, during the 1978 Industrial Chemical resurvey/inspection, a chemical engineer at the Pall Corporation alledged a past history of chemical dumpage down drains and in the yard of both the Pall Corporation and the neighboring HMS machine shop yard (see Appendix A). Any company using or storing organic chemicals may be subject to inadvertent discharges caused by improper storage and handling techniques, container leaks or accidental spills. Stormwater drywells and/or floor drains connected to drywells could provide a direct conduit for entry of such chemical discharges into the water table aquifer.

A report by the NCDH dated August 6, 1978 (see Apendix A) documents the

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discussion with the Pall Corporation engineer. Additionally, an August 31, 1977 NCDH report discusses the discharge of low level solvent waste to the City of Glen Cove sewer system and the presence of small quantities of solvents in the local storm drains. Leaky storm and sanitary sewers, therefore, could represent a low level diffuse source to the water table.

As discussed previously, VOC analyses of Glen Cove Creek and of the numerous monitoring wells indicate a source area of VOC's between Glen Head Country Club and Sea Cliff Avenue. In light of this information, site-specific investigations are warranted.

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## 4.0 CONCLUSIONS

Based upon the findings of this investigation, the following conclusions are presented.

1. A groundwater contamination plume of volatile organic chemicals has been identified emanating from the Sea Cliff Avenue industrial zone. The plume extends from the water table to the base of the upper glacial aquifer. The plume apparantly has migrated into the capture zone of the City of Glen Cove's Carney Street public supply wells causing their closure in 1977.

2. The water table portion of the plume bifurcates away from the source area. The southern fork of the plume has migrated westerly with groundwater flow a minimum horizontal distance of 2,400 ft. from the source area. Total volatiles range to 576 ug/L and the plume extends a minimum of 30 ft. into the aquifer. The northern fork of the plume has migrated northerly with the ground water flow a minimum of 2,400 ft. from the source area and extends a minimum of 18 ft. into the aquifer. Total volatiles range from up to 5,500 ug/L immediately downgradient of the Sea Cliff Avenue industrial zone dropping off to 60 ug/L at the northern fringe of the plume.

3. The deep glacial portion of the plume has migrated northwest with the deep glacial groundwater flow a minimum horizontal distance of 2,400 ft. from the source area. The plume has extended to the base of the aquifer at the source area to a depth of - 134 ft. below sea level and at the furthest downgradient well to a depth of - 115 ft. below sea level. A strong upward component of groundwater flow at the City of Glen Cove's Carney Street well field due to the higher consistent deep glacial potentiometric heads relative to the lower water table heads at, and adjacent to, Glen Cove Creek has limited the contamination to the mid and water table levels of the aquifer. Total VOC levels range from 698 ug/L in the vicinity of the source area to 79 ug/L at the downgradient fringe of

the plume.

4. The water table contamination, through advection and vertical components of groundwater flow brought about by industrial well pumpage, has migrated downward into the deep industrial supply wells and is subsequently reintroduced back into the aquifer through diffusion wells set at different depths (screen elevations). Winter non to low industrial pumpage conditions apparantly has allowed the downgradient advective migration of the deep plume to an area outside the effective radius of influence of the industrial supply wells during the pumpage season.

5. Industrial pumpage and diffusion of up to 2 million gpd during the demand season has been partially quantified with regard to the hydrodynamic dispersion of the groundwater contamination. Pumpage induced water level deflections of up to 0.4 ft. at the Carney Street well field have been quantified 900 ft. north of the closest industrial supply well. Therefore, the cone(s) of influence(s) of the industrial supply well(s) extend outward a minimum of 900 ft. and to the base of the aquifer during the demand season. As can be seen in Figure 3-18, this pumpage and diffusion has caused the contamination to remain localized at the Sea Cliff industrial zone. Additionally, demand season pumpage apparently has a measurable effect on the vertical gradients at downgradient wells GC-4 and 5, approximately 1,100 and 2,000 ft. north and northwest of the industrial zone, respectively. A reversal of vertical groundwater gradients were recorded from near horizontal to slightly downward during the demand season to upward during the winter non to low pumpage season at these wells. However, due to the volume of industrial pumpage, a lack of site specific data, and the inherent hydrodynamic complexities involved with the pumpage and contaminant dispersion, further study is warranted to more thoroughly establish the relationship between the aquifer, pumpage rates and contaminant transport.

6. Numerous industries, both past and present, have used the organic chemicals identified in the groundwater. Additionally low level solvent waste has been discharged to the sanitary sewers in the past which could potentially leak into the water table aquifer. Accidental or intentional discharge of solvents are not uncommon at industrial establishments handling such chemicals over a period of forty years. Therefore, site-specific investigative work is warranted to define potential source areas and the overall contribution of each of these industries to the extensive groundwater VOC plume which currently exists.

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5.0 RECOMMENDATIONS

1. The findings of this report should be presented to the City of Glen Cove and the New York State Department of Environmental Conservation for State or Federal Superfund Consideration.

2. All industrial users of groundwater for non contact cooling and air conditioning purposes who may not be in compliance with the New York State Pollutant Discharge Elimination System (SPDES) regulations should be required to meet all relevant SPDES standards.

3. Further site-specific investigations are warranted at the present or former industrial locations where volatile organic chemicals were or are stored and utilized to further define potential sources. These investigations should include:

- Soil gas surveys and soil sampling at present or former drum/chemical storage areas
- Soil sampling of all storm water drywells open to the aquifer
- The investigation of inadvertent or potential chemical discharge or spill areas
- The review of all industrial chemical storage and usage to assure compliance with all applicable County, State and Federal regulations and laws
- The installation of water table and deep monitoring wells to further define the three dimensional extent of the VOC plume and to further determine the effects of industrial pumpage on contaminant dispersion.
- If warranted, conduct full Remedial Investigations and Feasibility Studies (RI/FS) under CERCLA following Federal Environmental Protection Agency and New York State Department of Environmental Conservation protocols at the sites representing a potential or significant threat to human health or the environment.

4. Continue monitoring the VOC plume emanating from the Sea Cliff Avenue industrial zone, and construct additional monitoring wells if necessary, to assess its impact on potential downgradient receptors such as the well capture zone of public water supply well 9334 (City of Glen Cove-Kelly Street well) and the well head of public water supply well 7857 (Sea Cliff Water Company).

5. All future efforts by the private and government sectors should focus on an expeditious plan for the remediation of the local contaminated aquifer segment.

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## 6.0 REFERENCES


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**Appendix A**

**Nassau County Department of Health**
**Industrial Chemical Profile**

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APPENDIX A

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK
TABLE 1 - TYPES OF FACILITIES FOUND IN THE GLEN COVE STUDY AREA

| Industrial Division by SIC Group No. (1) | Number of Facilities |
|---|---|
| Agricultural, Forestry, Fishing | |
| Major Group 07. Agricultural Services | 1 |
| Construction | |
| Major Group 17. Construction - Special Trade Contractor | 2 |
| Manufacturing | |
| Major Group 23. Apparel and other finished products made from fabrics and similar materials | 4 |
| Major Group 24. Lumber and wood products | 2 |
| Major Group 25. Furniture and fixtures | 4 |
| Major Group 30. Rubber and miscellaneous plastic products | 2 |
| Major Group 32. Stone, clay, glass, and concrete products | 1 |
| Major Group 34. Fabricated metal products | 6 |
| Major Group 35. Industrial and Commercial Machinery and computer equipment | 2 |
| Major Group 36. Electronic and other electrical equipment and components | 8 |
| Major Group 37. Transportation equipment | 2 |
| Major Group 38. Measuring, analyzing, and controlling instruments; photographic, medical and optical goods; watches and clocks | 2 |
| Major Group 39. Miscellaneous manufacturing industries | 1 |

APPENDIX A

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK
TABLE 1 - TYPES OF FACILITIES FOUND IN THE GLEN COVE STUDY AREA

| Industrial Division by SIC Group No. (1) | Number of Facilities |
|---|---|
| Transportation, communications, electric, gas, and sanitary services | |
| Major Group 42. Motor freight transportation and warehousing | 1 |
| Wholesale Trade | |
| Major Group 50. Durable goods | 3 |
| Major Group 51. Nondurable goods | 6 |
| Retail Trade | |
| Major Group 52. Building materials, hardware, garden supply | 2 |
| Major Group 54. Food stores | 1 |
| Major Group 55. Automotive dealers and gasoline service stations | 3 |
| Major Group 59. Miscellaneous retail | 1 |
| Services | |
| Major Group 72. Personal services | 2 |
| Major Group 73. Business services | 3 |
| Major Group 75. Automotive repair, services, and parking | 8 |
| Major Group 76. Miscellaneous repair services | 3 |
| Major Group 78. Motion pictures | 1 |
| Major Group 79. Amusement and recreational services | 2 |
| Major Group 87. Engineering, accounting, research, management and related services | 1 |

(1) The Standard Industrial Classification (SIC) is the statistical classification standard underlying all establishment based Federal economic statistics classified by industry. Each establishment is assigned an industry code based on its primary activity, which is determined by its principal product(s) produced or distributed, or services rendered.

APPE

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK
TABLE 2 - INDUSTRIAL CHEMICAL PROFILE OF CARNEY STREET WELL FIELD AREA
CURRENTLY IN BUSNESS

| MAP NO. | FACILITY/ADDRESS | TYPE OF BUSINESS | DATE SURVEYED | CHEMICAL USAGE (IN GALLONS) | DISPOSAL METHOD | SEWERED | WELLS | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 1 | North Hills Electronic<br>Alexander Pl | Manufacturing (electronic equipment/PC Boards) | 8/2/77<br><br>3/27/87<br>ARTICLE XI | 1,1,1 Trichloroethane (75)<br>Paint thinner (10)<br>Ferric Chloride (50)<br>Photochemicals (20)<br><br>Freon (PT35/TMS) (275)<br>Alcohol (110)<br>Ferric chloride (110)<br>Misc. oils (5)<br>Alodine (15 lbs)<br>Photochemicals (5 lbs)<br>Paint (30)<br>Paint thinners (10)<br>Cutting oil (5)<br>Solder flux (15) | Applied w/ rags<br>Used in paints<br>Spent plating solution goes to drywell<br><br>Industrial waste transporter | Yes Since 1968 | | 1974 Cosulich report - Rinse water from Alodi<br>Ferric chloride & Tin baths dumped in back yar<br>once a year.<br>1977 NCDH survey - Rinse solution from platin;<br>pumped to drywell.<br>1977 SPDES application indicates a discharge c<br>rinsewater (50 gal/day) going into the ground.<br>1983 survey - indicates use of industrial was:<br>transporters.<br>Facility listed in 1988 Sidney Bowne & Sons Pa |
| 2 | Micronics Technology<br>7 Alexander Pl | Manufacturing (microwave subassemblies) | 9/26/88 | Conformal coating (1)<br>Acetone (5)<br>Isopropanol (5)<br>Epoxy glue (2)<br>Solder flux (1)<br>Metal cleaner (18% HCl) (1)<br>Freon (1)<br>Pride FCA blend (1,1,1 Tri, Freon TF, isopropanol) (20)<br>Freon TP (No longer used) | Applied to products<br>Applied w/Q tips, then discarded<br>On products<br>On products<br>Q tips discarded<br>Evaporates<br>Solvent exhausted | Unknown | | At location since 1/88 - previously occupied :<br>Displex (subsidary of North Hills Electronics) |
| 3 | Odin Claims<br>4 Carney St | Private investigations office | 9/25/88 | None | | Yes | | At location since 1986.<br>Building vacant prior to current occupant. |
| 4 | Glen Cove Iron Works<br>34 Carney St | Welding shop | 9/26/88 | Paint (10)<br>Paint thinner (2)<br>Turpentine (2)<br>Kerosene (5) | Product<br>Mixed with paint<br>Evaporates<br>Used in heating | Unknown | | At location since 1981. No water service at<br>this address. Property sublet from residence<br>next door. |
| 5 | Man Product<br>(MJM Product)<br>100 Carney St | Fabrication of steel sheds & cellar doors | 3/24/77<br><br>7/20/77<br><br>2/3/87<br>ARTICLE XI | Paint primer (1750)<br>Naptha (1000)<br><br>VMP Naptha (12,000)<br><br>Naptha U/G tank (4,000)<br>#2 Fuel oil U/G tank (1,000)<br>Paint (250)<br>Hydraulic oil (15) | Product<br>Product<br><br>Product<br><br>Industrial transporter and/or Glen Cove Resource Recovery Facility | Yes (since 1968) | | 1981 - Inspector noted paint and solvent<br>accumulated for pickup.<br><br>1982 - Received first waste report.<br>6/87 - U/G #2 fuel oil tank leaked.<br>1987 - Waste disposed of at Glen Cove Resourc<br>Recovery Facility.<br>1994 Inspection revealed an accumulation of s:<br>ified paint primer dumped in back of bldg.<br>Co. removed as directed. |

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APPENDIX A

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK
TABLE 2 - INDUSTRIAL CHEMICAL PROFILE OF CARNEY STREET WELL FIELD AREA
CURRENTLY IN BUSNIESS

| MAP NO. | FACILITY/ADDRESS | TYPE OF BUSINESS | DATE SURVEYED | CHEMICAL USAGE (IN GALLONS) | DISPOSAL METHOD | SEWERED | WELLS | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 6 | Glen Cove Bowl<br>200 Carney St | Bowling alley | 9/26/88 | Lane cleaner (UK)<br>Lubes - spray cans (UK)<br>Hand cleaner (UK)<br>General purpose cleaner (UK)<br>Safety Kleen (30 gal tank) | Rags service<br>On machinery<br>Sewer<br>Rags service<br>Picked up by Safety Kleen | Yes | | At location since 1958. Previous to bowling alley was a casket mfg. |
| 7 | Rallye Motors<br>20 Cedar Swamp Rd | Sales & Service autos | 12/8/77<br><br>9/88 PHONE SURVEY | Klearflo (80) (aliphatic hydrocarbons & mineral spirits)<br>Safety Kleen | Picked up by industrial waste transporters<br>Picked up by Safety Kleen | Yes | | 1977 survey - rinse water goes to sewer<br>Previous to Rallye Motors was vacant land.<br>1981 State ICS indicates liquid is discharged t |
| 8 | Mahoney Auto Parts<br>33 Cedar Swamp Rd | Sales of auto parts | 9/15/88 | Safety Kleen | Picked up by Safety Kleen | Yes | | At location since 1976.<br>Have a 500 gal U/G fuel oil tank. |
| 9 | M. L Bianconi Funeral Home<br>62 Cedar Swamp Rd | Funeral Home | 9/21/77<br>8/29/88 | Formaldehyde (100)<br>Misc. Embalming fluids (155) | Body preservative | Yes | | 9/88 survey of area- still at this location. |
| 10 | Luyster Motors<br>70 Cedar Swamp Rd | Car repair & body shop | 10/20/88 | Paint thinners (900)<br>Lacquer thinner (30)<br>Lube oil (100)<br>Motor oils (5,000)<br>Antifreeze (100)<br>Transmission fluid (125)<br>Safety Kleen (720) | Picked by industrial scavenger<br>Drain into u/g tank (tank 25 years old)<br><br>Picked up by Safety Kleen | Yes | | At location since 1948. Floor drain in middle c shop connected to sewers. 1980 flow of keroser from a storm drain on property. Interior drair were connected to an oil/water separator whose discharge went to several leaching basins which overflowed to the storm drainage system which discharged to Cedar Swamp creek. |
| 11 | ANG's Service Station<br>73 Cedar Swamp Rd | Auto repairs | 10/17/88 | Brake fluid (25)<br>Lube oil (900)<br>Gear oil (900)<br>Kerosene (825) | Waste oil tank<br>Picked up by industrial transporters | Yes | | At location since 1946. Previously vacant lan<br>No degreasers are used.<br>Underground tanks:<br>waste oil - 2,000 gal<br>gasoline - (2) 6,000 gal<br>fuel oil - 550 gal<br>Above ground tanks:<br>kerosene - (3) 275 gal<br>1988 survey- rents part of the property to Ang<br>Stanco Landscaping (used primarily for pesticid |
| 12 | Angelina Izzo & Sons<br>3 Gabriel St<br>(corner of 4th St) | Import & store grapes | 10/17/88 | None | | Yes | | At location since 1973. |
| 13 | Roma Art Creations LTD<br>79 Hazel St | Distribute art prints | 9/25/88 | None | | Unknown | | At location since 1987. |
| 14 | THEA Energy Cost Control Center | Engineering office, air & heating | 9/15/88 | Ammonia (10) | Used in blueprint machines | No | | At location since 1978. |

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INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK
TABLE 2 - INDUSTRIAL CHEMICAL PROFILE OF CARNEY STREET WELL FIELD AREA
CURRENTLY IN BUSNESS

| MAP NO. | FACILITY/ADDRESS | TYPE OF BUSINESS | DATE SURVEYED | CHEMICAL USAGE (IN GALLONS) | DISPOSAL METHOD | SEWERED | WELLS | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 15 | Factory Service Parts & Controls<br>81 Hazel St | Distribute pump parts | 9/26/88 | None | | Yes | | Rent from INBA |
| 16 | Long Island Video<br>83 Hazel St | Produce video tapes | 9/26/88 | Lens cleaner (2) | Evaporates | Yes | | At location since 1/88. |
| 17 | Aqua Scooter<br>85 Hazel St | Distribute & service water scooters | 9/15/88 | None | | Yes | | At location since 1984.<br>Processor - Acco-Bristol Datamaster |
| 18 | Shadow Box<br>85 Hazel St | Picture frames | 9/15/88 | Alcohol (12) | Evaporates | No | | At location since 8/88. |
| 19 | Greenvale Auto Parts<br>85 Hazel St | Sales - auto parts | 9/15/88 | None | | No | | At location since 1986. |
| 20 | Max Wiener & Co.<br>Learsi Leather<br>88 Hazel St | Import leather outerwear | 9/25/88 | Propane tanks<br>Floor cleaner | Fuel for fork lift<br>Sewer | Yes | | At location since 1978. |
| 21 | Photocircuits<br>90 Hazel St | Drilling printed circuit boards | 8/88 | None | | Yes | Uses water cooled air compressor (closed loop) | Photocircuits took samples of building before moving in: Swipe sample of floor, testing soil & indoor air; indicate presence of methylene chloride, 1,1,1 trichloroethane, toluene (0.09 - 1.05 ppb ) from the floor swipe. Soil samples: methylene chloride (10 ppb), trichlorofluoromet' (59 ppb), tetrachloroethylene (9 ppb) |
| 22 | Village Laundromat<br>Hazel St/Grove St | Laundromat | NEVER SURVEYED | | | | | No dry cleaning - only washing machines noted. |
| 23 | Joy Edd Trim Shop<br>1 Sea Cliff Ave | Dog Grooming | 9/15/88 | None | | No | | At location since 1976 |
| 24 | Hinkle & Finlayson<br>Harbor Fuel Oil<br>10 Sea Cliff Ave | Office, oil truck garage, maintenance | 10/31/88 | Safety Kleen (UK)<br><br>National Chemsearch 150 (UK)<br>Engine degreaser (UK)<br>Motor oil (UK) | Recycled, picked up by Safety Kleen<br>Waste oil tank<br>Waste oil Tank<br>Waste oil Tank | Yes | | At location since 1933<br>Underground Tanks:<br>Gasoline (1,000) gallons<br>Fuel oil (2,000) gallons<br>Fuel oil (1,000) gallons<br>Aboveground Tanks:<br>waste oil (275) gallons |

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INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK
TABLE 2 - INDUSTRIAL CHEMICAL PROFILE OF CARNEY STREET WELL FIELD AREA
CURRENTLY IN BUSNESS

| MAP NO. | FACILITY/ADDRESS | TYPE OF BUSINESS | DATE SURVEYED | CHEMICAL USAGE (IN GALLONS) | DISPOSAL METHOD | SEVERED | WELLS | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 25 | Pall Corporation<br>30 Sea Cliff Ave<br><br>(Former names:<br>Micrometalic<br>Aircraft Porous<br>Media and<br>Glen Components) | Manufacturing<br>(Filters) | 3/10/87<br>ARTICLE XI | Ethylene glycol monoether (110)<br>Hydraulic oil (1100)<br>Freon TF (110)<br>Machine oil (55)<br>Acetic acid (1)<br>Ethanol (55)<br>Petroleum ether (55)<br>Hydrochloric acid (110)<br>Dimethylacetamide (110)<br>Isopropanol (55)<br>Sodium Hydroxide (55)<br>Methylene chloride (275)<br>Acrylic Acid (110) | Records on file (since 1979) wastes picked up by industrial waste transporters | Yes | N-2316<br>N-6872<br>N-7919D<br>N-7083T<br>N-7084D<br>N-7085D<br>N-7153D<br>N-7154D<br>N-7155D<br>N-8886D | At location since 1946.<br>1967 inspection - wasteline removed adjacent to well. A whiteish sludge (aluminum oxide) noted at severed pipe.<br>1977 survey - Halogenated solvents (tetrachloroethylene and trichloroethylene) used in past but mfg. facilities have moved to Florida in 1972<br>1978 Resurvey/Inspection - Chemical engineer at Pall indicates past history of dumping chemicals down drains and yards.<br>1978 inspection revealed a messy chemical storag shed approximately 250 feet from the wells.<br>1980 -Issued Non-Discharge SPDES (Store & Remove permit<br>1987 Waste Report - Following chemicals bought:<br>Tetrachloroethylene - 1000 ml<br>Methylene chloride - 16,200 lbs<br>Trichloroethylene - 16 liters<br>1,1,1 Trichloroethylene - 1.6 liters<br>1974 Cosulich report indicates cooling water was recharged to the ground in the past. |
| 26 | Photocircuits<br>31 Sea Cliff Ave | Manufacturing<br>(printed circuit boards) | 3/17/87<br>ARTICLE XI<br><br>2/25/77<br>SURVEY | PM Acetate (4,000)<br>Copper chloride (5,000)<br>Methylene chloride (5,000)<br>Hydrochloric Acid (7,000)<br>Copper bath (8,000)<br>Sulfuric Acid (6,000)<br>Trichloromethane (8,000)<br>Ammonium hydroxide (2,500)<br>Sodium persulfate (4,000)<br>Caustic solutions (1,000)<br>Formaldehyde (5,000)<br><br>Methylene chloride (71,013)<br>1,1,1 Trichloroethane (11,194) | NCDH has records (since 1980) that 1,1,1 Tri-chloroethane and methylene chloride sludge picked up by industrial waste transporters | Yes since 1956 | N-7427<br>N-8224<br>N-7452D<br>N-7453D<br>N-8930D<br>N-8931D<br>N-9773D<br>N-10107D<br><br>10 diffusion wells<br><br>Cooling water wells are chlorinated before recharge | From a 1977 survey - Tetrachloroethylene used in 1956.<br>Switched to 1,1,1 Trichloroethane prior to 1965.<br>Using 1,1,1 Trichloroethane and Methylene chloride since this time.<br>1961 files indicates sewers overflowed on many occasions.<br>1962 letter stated during the construction of t' system, Photocircuits given permission to remove wastewater from the sanitary sewer and connect t storm sewer which discharges into the creek.<br>Aboveground tanks of 1,1,1 Trichloroethane:<br>waste (2,000) gallons<br>fresh 3-(1,000) gallons<br>fresh (6,000) gallons<br>Aboveground tanks of Methylene chloride:<br>waste (2,000) gallons<br>fresh 2-(6,000) gallons<br>fresh (100) gallons<br>1977 Inspection - Roof drains and parking lot s' drains discharge to the creek. |

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INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK
TABLE 2 - INDUSTRIAL CHEMICAL PROFILE OF CARNEY STREET WELL FIELD AREA
CURRENTLY IN BUSNESS

| MAP NO. | FACILITY/ADDRESS | TYPE OF BUSINESS | DATE SURVEYED | CHEMICAL USAGE (IN GALLONS) | DISPOSAL METHOD | SEWERED | WELLS | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 27 | August Thomsen Corp.<br>36 Sea Cliff Ave. | Manufacturing (Cake decorating utensils) | 10/6/88 | Inks (2)<br>Paints (18)<br>Paint thinners (2)<br>Oils, misc (2)<br>Polishing compounds (20) | On products<br>On products<br>Evaporates<br>Exhausted<br>Treated w/lime<br>Sludge collected in 55 gal drums | Yes since 1962 | private well abandoned N-6579 | At location since 1971<br>Note: Owner of well as listed in the well schedu<br>Aircraft Porous Media (Division of Pall Corp. |
| 28 | Associated Drapery Equipment<br>Novelty Scenic Studios<br>40 Sea Cliff Ave | Manufacturing (draperies) | 10/31/88 | None | | Yes since 1962 | | No treatment of fabrics performed on premises.<br>At location since 1972. |
| 29 | Earl Electric Mfg.<br>44 Sea Cliff Ave | Assemble electrical conduit fittings | 6/27/77<br>NCOM ICS<br>4/3/83<br>STATE ICS | No chemicals<br><br>No chemicals | | Yes since 1960 | | Cooling water from die casting is discharged to sewers. At location since 1973. |
| 30 | American Best Coffee<br>44 Sea Cliff Ave | Distributor (expresso & pasta machines) | 9/22/88 | None | | No | | At location since 1987. |
| 31 | Lau's Cabinets<br>44 Sea Cliff Ave | Manufacturing (Cabinets) | 9/14/88 | Lacquer thinner (60) | Evaporates | No | | At location since 3/88 |
| 32 | Philip C. Antico Consultants<br>44 Sea Cliff Ave | Interior designers for food & lounging industry | NEVER SURVEYED | | | | | 1988 survey of area.<br>Current occupant<br>At location since 1986. |
| 33 | Orobello Inc.<br>44 Sea Cliff Ave | Electrical contractors | NEVER SURVEYED | | | | | 1988 survey of area.<br>Current Occupant - At location since 1982. |
| 34 | One Step Food Supply<br>44 Sea Cliff Ave | Food store | NEVER SURVEYED | | | | | 1988 survey of area.<br>Current Occupant - At location since 1986. |
| 35 | Slater Development Corp.<br>44 Sea Cliff Ave | Office only | NEVER SURVEYED | | | | | 1988 survey of area.<br>Current Occupant |
| 35 | Slater Electric<br>45 Sea Cliff Ave | Manufacturing (wiring devices) | 2/26/77 | Tetrachloroethylene (4500)<br>1,1,1 Trichloroethane (375)<br>Xylol (165)<br>Acetone (10) | Industrial transporters (1,1,1 Trichloroethane & Tetrachloroethylene sludge) | Yes since 1957 | N-8887<br>N-9612<br>N-8892<br>N-89070<br>N-96140<br>N-96150<br>N-96930 | 1988 Inspection - Recent spill of #2 fuel oil<br><br>1981 Inspection - A storm drain is located in t<br>of waste solvent storage area which is not berr<br>SPDES facility from 1979 to 1986, discharged C:<br>non-contact cooling water.<br>Storm water drains located on east side of prc:<br>drains into Glen Cove Creek. |

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INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK
TABLE 2 - INDUSTRIAL CHEMICAL PROFILE OF CARNEY STREET WELL FIELD AREA
CURRENTLY IN BUSNESS

| MAP NO. | FACILITY/ADDRESS | TYPE OF BUSINESS | DATE SURVEYED | CHEMICAL USAGE (IN GALLONS) | DISPOSAL METHOD | SEWERED | WELLS | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 37 | Keyco Inc.<br>450 Sea Cliff Ave | Freight transfer station & truck repair shop | 9/14/88<br>2/17/78 | None<br>Kerosene (UK) | <br>Waste oil transporter | Yes but Cesspools indicated in 1974 report by Cosulich | | At location since 1955.<br>1977 survey indicated cesspools for sanitary waste. |
| 38 | Zcomar Inc.<br>55 Sea Cliff Ave | Grinding and polishing optical lenses | 10/20/88 | Polishing Compounds (3)<br>Soluble oil (5)<br>Acetone (20)<br>Pureline solvent | Exhausted in process<br>Oil bath to garbage<br>Evaporates<br>Recycled | Yes since 1953 | N-4980 | Floor drains in room where pureline is used.<br>At location since 1953.<br>(No predessessor - only vacant land). |
| 39 | Sun Carting<br>59 Sea Cliff Ave | Carting Co. | NEVER SURVEYED | | | | | At location since 1984. |
| 40 | Sea Cliff Coal and Lumber<br>59 Sea Cliff Ave | Bldg. material supplier | 7/21/77 | None | | Yes | | |
| 41 | Epco (Apco) Plastics<br>59 Sea Cliff Ave | Machining of plastic aircraft parts | 9/14/88 | None | | No | | At location since 1983. |
| 42 | William T. Geertseen Landscaping<br>59 Sea Cliff Ave | Grounds maintenance | 11/4/88 | Fertilizer (1250)<br>Gasoline (5)<br>Pesticide (5) | Lawns<br>Lawn mowers<br>Lawns | Unknown (no running water) | | Used primarily as storage of lawn mowers and trucks.<br>At location since 1973. |
| 43 | T&D Autobody Works<br>59 Sea Cliff Ave | Autobody repairs and towing | 9/14/88 | None | | No | | Noted antifreeze puddles in front of building.<br>At location since 1973. |
| 44 | Tudors Auto Club<br>59 Sea Cliff Ave | Auto club (car repairs) | NEVER SURVEYED | Site inspection:<br>Kerosene<br>Lacquer thinner | | Unknown | | Club open only on nights and weekends.<br>At location since 1978. |
| 45 | F&J Precision Tooling Precision Machine Pdts<br>59 Sea Cliff Ave | Machine products | 9/14/88<br><br>7/21/77 | None<br><br>Cutting oils (55) | <br><br>Used on machined parts | No | | At location since 1973 |
| 46 | R-Tex Decoratives<br>59 Sea Cliff Ave | Fabric distributor (window displays) | 9/14/88<br>4/18/86 | Water based glue (UK)<br>Ammonia (100)<br>Water based adhesive (600)<br>Dyes (5) | Product<br>Product | No | | At location since 1970. |
| 47 | Let Byegones Be<br>59 Sea Cliff Ave | Furniture refinishing | 11/4/88 | Enamel paints (small quanity)<br>Paint thinner (small quanity)<br>Adhesives (small quanity) | On furniture<br>Mixed w/paints<br>On furniture | Unknown | | At location since 1978. |

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INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK
TABLE 2 - INDUSTRIAL CHEMICAL PROFILE OF CARNEY STREET WELL FIELD AREA
CURRENTLY IN BUSNESS

| MAP NO. | FACILITY/ADDRESS | TYPE OF BUSINESS | DATE SURVEYED | CHEMICAL USAGE (IN GALLONS) | DISPOSAL METHOD | SEWERED | WELLS | COMMENTS |
|---|---|---|---|---|---|---|---|---|
| 48 | Sea Cliff Auto Radiator<br>59 Sea Cliff Ave | Auto radiator repairs | 11/4/88 | Muriatic acid (12)<br>Zinc solder flux (12) | Dissipates in tank<br>On parts | Yes | | Floor drains in metal cleaning area.<br>At location since 1975. |
| 49 | Walter J. Moretto Masonary<br>53 Sea Cliff Ave | Sales of masonary supplies | 11/4/88 | Muriatic acid (30)<br>Silicone (60)<br>Kerosene (50) | Resale products<br>Resale products<br>Fuel for heater | Unknown | | Occupies 3 buildings within 59 Sea Cliff Ave complex.<br>At location since 1978. |
| 50 | Sea Cliff Iron Works<br>53 Sea Cliff Ave | Manufacturing (iron railings) | 11/4/88 | Enamel paints (25)<br>Mineral spirits (15)<br>Cutting oils (2qts) | Product<br>Mix w/paints<br>On machines | Yes | | At location since 1984.<br>A body shop was at this location before S.C. Iron Works. |
| 51 | Monte Displays<br>59 Sea Cliff Ave | Manufacturing (scale models of swimming pools) | 11/4/88 | Adhesive (10)<br>Lacquers (15)<br>Lacquers thinners (15)<br>Contact cement (50)<br>Denatured alcohol (2)<br>Combond Kleen-Up (15) contains benzene and toluene)<br>Silk screening inks (10) | On product<br>On product<br>or use wipe rags to wipe excesses - rags are discarded in dumpsters after drying | No | | Previous occupant was a wood molding mfg. plant<br>At location since 1972. |
| 52 | Cove Tennis Center<br>60 Sea Cliff Ave | Tennis courts | 9/14/88 | | | Yes | | At location since 1982. |
| 53 | LI Glass & Mirror<br>65 Sea Cliff Ave | Manufacturing (glass items) | 9/15/88 | Kerosene (55)<br>Grinding oil (55)<br>Glass cleaner (110) | Rags Discarded<br>Machines<br>Rags Discarded | No | | Floor drains in glass grinding area.<br>1988 inspection - outside storm drains overflowing with water.<br>Formerly at 63 Sea Cliff Ave. Present location : |
| 54 | JC Covino Electric<br>3 Second St | Electrical contractors | 10/17/88 | None | | Yes | | At location since 1980. |

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INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK
TABLE 3 - INDUSTRIAL CHEMICAL PROFILE OF CARNEY STREET WELL FIELD AREA
OUT OF BUSINESS

| FACILITY/ADDRESS | TYPE OF BUSINESS | DATE SURVEYED | CHEMICAL USAGE (IN GALLONS) | DISPOSAL METHOD | SEWERED | WELLS | COMMENTS |
|---|---|---|---|---|---|---|---|
| CHIU Technical Corp. Alexander Pl | Manufacturing (medical instruments) | 8/2/77 | None | | Yes | | 1988 site inspection - out of business |
| Vesuvio Cheese Inc. 7 Alexander Pl | Distributes natural cheese | 4/12/81* | None | | Yes | | * Information from NYSDEC Industrial Chemical Survey<br>1988 site inspection - out of business |
| Kolco Canvas Products 10 Carney St | Manufacturing (canvas products) | 1974* | None | | Unknown | | * Information from 1974 Cosulich Report.<br>1988 site inspection - out of business.<br>Address is now an apartment house. |
| Carney St Auto Body 10 Carney St | General auto repair | 8/12/80 | Motor oil (80)<br>Safety Kleen (30) | Waste oil scavenger<br>Picked up by Safety Kleen | Yes | | 9/88 survey of area.<br>1988 site inspection - out of business.<br>Address is now an apartment house. |
| G. Glassman Inc. 18 Cedar Swamp Rd | Manufacturing (furniture frames) | 8/17/77 | None | | Yes | | 1988 site inspection - out of business<br>Currently at location - commercial stores |
| GC Fashions Mfg.Co. 79 Hazel St | Manufacturing (ladies coats) | 8/2/77 | Ever-Glum Cleaning Fluid (2) (1,1,1 Trichloroethane) | Evaporated | Yes | | 1988 survey - out of business. |
| Mattiace Petrochemical 79 Hazel St | Office only | Never Surveyed | | | Yes | | Evicted in 1987.<br>NOTE: In 1986, 79 Hazel St became 79, 81 and 83 Hazel<br>This address equal to 83 Hazel St. |
| Acco-Bristol Datamaster 85 Hazel St | Manufacturing (supervisory control equipment) * | Never Surveyed | | Machining waste to sewer * | Yes * | | * Information from 1968 S. Bowne and 1974 Cosulich re |
| Osrow Products (OSR Corp.) (Moonshine Products) 88 Hazel St | Manufacturing & assembling (plastic houseware items) | 10/25/77 | Ethylene dichloride (240) | Evaporates or on product | Yes | | 1988 survey of area - out of business.<br>1974 Cosulich report indicates a previous location: 160 Hazel St.<br>1968 Sidney Bowne report states the facility address 84 Hazel St. |
| Easter Unlimited 90 Hazel St | Assemble Easter baskets | NEVER SURVEYED | Adhesives (unknown) | Product | Yes | | Photocircuits moved into location 8/88.<br>1988 site inspection - out of business. |
| Glen Components (Div. of Pall Corp.) 36 Sea Cliff Ave | Machine Shop and Anodizing (aircraft parts) | NEVER SURVEYED | | | | | Predecessor to August Thomsen Corp.<br>Company moved to Florida in 1971. |

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INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK
TABLE 3 - INDUSTRIAL CHEMICAL PROFILE OF CARNEY STREET WELL FIELD AREA
OUT OF BUSINESS

| FACILITY/ADDRESS | TYPE OF BUSINESS | DATE SURVEYED | CHEMICAL USAGE (IN GALLONS) | DISPOSAL METHOD | SEWERED | WELLS | COMMENTS |
|---|---|---|---|---|---|---|---|
| HMS Machine Shop<br>40 Sea Cliff Ave | Machine Shop<br>(aircraft parts) | NEVER SURVEYED | Through interviews possible chemical usage:<br>Tetrachloroethylene (UK)<br>Trichloroethylene (UK) | | Yes since 1981 | | 1978 Resurvey of Pall Corp - Engineer stated he noted company spilled or dumped waste solvents in their yard. Co. closed in 1969.<br>1981 inspection indicates this facility was notified t have their sewer connection repaired. |
| Eastern Heat Treatment Co.<br>Bennett Heat Treatment Co.<br>44 Sea Cliff Ave | Metal Plater | NEVER SURVEYED | Unknown - possible solvents used in cleaning metal parts prior to plating operations. | | 1968 (Info from C. Rowne Report) | | Information from the 1978 resurvey of Pall Corp. and 1977 survey of Earl Electric.<br>Predecessor to Telco.<br>Moved out between 1968-1976. |
| Telco Inc.<br>44 Sea Cliff Ave | Manufacturing<br>(PCB for telephone related products) | 1977 | 1,1,1 Trichloroethane (110) | 1978 - Dirty solvent returned to distributor<br>1980 - Switched to recycling solvent.<br>1981 to closing - vapor degreaser not in use. | Yes | | 1990 - Non-discharge SPDES (Store & Remove) permit<br>1983 - Co. moved to Roslyn. |
| Quadraframe<br>44 Sea Cliff Ave | Manufacturing<br>(picture frames) | 2/5/88 | None | | Yes | | At location in 1984. 1988 survey out of business. |
| Hadax Electronics<br>Doryt Systems<br>44 Sea Cliff Ave | Assemble switching components | 2/5/88<br><br>7/23/86 | Butyl cellosolve (5)<br><br>Tapping oil (1) | On hand (given list of waste transporters)<br>Used in machines. | Yes | | At location since 1984<br>1988 survey - Out of business (moved to New Jersey) |
| Stasi Woodworking Co.<br>Tom Stasi Kitchens<br>59 Sea Cliff Ave | Cabinet maker | NEVER SURVEYED | None | | No | | Information from 1974 Cosulich Associates report. |
| Raquette Sales<br>59 Sea Cliff Ave | Packaging plant | 7/20/77 | None | | No | | 9/19/88 survey of area - out of business.<br>Listed in 1974 Cosulich report. |
| Rosco Labs/Gelatine Products Corp.<br>83 Sea Cliff Ave | Repackage theatrical smoke fluid & mfg gelatine sheets for stage lights | 9/14/88 | Essential oils (150)<br>Smoke fluid (400) | Final product<br>Final product | Yes | | At location since 1980.<br>1989 Site inspection - Out of Business.<br>Reflections (part of LI Glass & Mirror) occupies this location<br>1974 Cosulich report indicates their former address: 32 Morris Ave., Glen Cove |
| The Olde Cabinet Shop<br>83 Sea Cliff Ave | Woodworking | 8/19/86 | Lacquer (50)<br>Lacquer thinner (50)<br>Contact Cement (25)<br>Water base Glue (25) | Product<br>Evaporates<br>Product<br>Product | No | | 10/88 survey of area - out of business. |

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APPENDIX A

INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
CITY OF GLEN COVE
NASSAU COUNTY, NEW YORK
TABLE 3 - INDUSTRIAL CHEMICAL PROFILE OF CARNEY STREET WELL FIELD AREA
OUT OF BUSINESS

| FACILITY/ADDRESS | TYPE OF BUSINESS | DATE SURVEYED | CHEMICAL USAGE (IN GALLONS) | DISPOSAL METHOD | SEWERED | WELLS | COMMENTS |
|---|---|---|---|---|---|---|---|
| Lawrence Mills<br>63 Sea Cliff Ave | Sales and warehouse | 7/20/77 | None | | Yes | | 1988 site inspection - out of business.<br>Information from 1974 Cosulich Report. |
| Nippon Electric Co. (NEC) Telephones<br>63 Sea Cliff Ave | Telephone equipment | NEVER SURVEYED | None | | Unknown | | Information from 1974 Cosulich Report<br>1988 site inspection - out of business. |
| Pikuhit Industry<br>63 Sea Cliff Ave | Manufacturing (oil pumping units) | NEVER SURVEYED | None | | Unknown | | Information from 1974 Cosulich Report<br>1988 site inspection - out of business. |
| Olympic International LTD<br>63 Sea Cliff Ave | Distribution of electronic equipment | 8/18/88 | None | | Yes | | 10/88 survey of area - out of business. |
| Pall Corp.<br>65 Sea Cliff Ave | Offices and warehouse | 8/18/88 | None | | Yes | | 10/88 survey of area - out of business. |

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# APPENDIX A

## INVESTIGATION OF CONTAMINATED AQUIFER SEGMENT
## CITY OF GLEN COVE
## NASSAU COUNTY, NEW YORK

### TABLE 4 - RESULTS OF NCDH TESTING OF SPDES PERMIT DISCHARGES FROM SLATER ELECTRIC, 45 SEA CLIFF AVENUE

| COMPOUND | DATE SAMPLED | | | |
|---|---|---|---|---|
| | 11/08/79 | 11/10/82 | 07/05/84 | 01/30/86 |
| Trichloroethylene | NA | 85 | <1 | 110 |
| Tetrachloroethylene | NA | 10 | <1 | 11 |
| 1,1,1-Trichloroethane | NA | 5 | <1 | 7 |
| Total Halogenated and Aromatic Hydrocarbons | ND | 112 | ND | 136 |

Results in micrograms per liter (ug/l)
NA = Not Analyzed
ND = Not Detected
SPDES = State Pollution Discharge Elimination System
NCDH = Nassau County Depatment of Health

NASSAU COUNTY DEPARTMENT OF HEALTH

240 OLD COUNTRY ROAD
MINEOLA, N.Y. 11501

RALPH G. CASO
County Executive
JOHN J. DOWLING, M.D., M.P.H.
Commissioner
FRANCIS V. PADAR, P.E.
Asst. Deputy Commissioner
Div. of Environmental Health

# STATUS REPORT OF INVESTIGATION OF ORGANIC CONTAMINATION CARNEY STREET WELLFIELD, GLEN COVE

August 31, 1977

## Background

In response to the closure of public water supply wells at Glen Cove's Carney Street wellfield, the Department initiated an investigation into the source of contamination.

During the period June 30 to July 26, a series of ten samples were collected for organic analysis from various locations in the vicinity of Carney Street, including waste discharges, drains, groundwater, and Cedar Swamp Creek. Not included in this report are sample results from public and private wells located within and in the vicinity of the affected area.

## Results

Sampling results are included in the attached table.

## Interim Conclusions

1. The contamination of the Carney Street wellfield by trichloroethylene and tetrachloroethylene is due to past waste discharges originating in an industrial area possibly as recent as five to ten years ago. The groundwater in the area is generally contaminated with these solvents, with highest concentrations focused in the industrial area located 1,000 feet southeast of the Carney Street wellfield.

2. Presently only two industries in the area, Slater Electric Company and Photo Circuits Corporation, use solvents of the same type found in the wells, as follows: Slater, 4500 gallons per year tetrachloroethylene; and Photo Circuits, 71,000 and 11,200 gallons per year of dichloromethane* and 1,1,1 trichloroethane, respectively. No present waste disposal practices were found which could account for the extent of contamination found. Solvent waste discharges of significant magnitude from both of these industries are presently being discharged into the Glen Cove sewer system. These include 1200 ppb of tetrachloroethylene from Slater Electric Company and 480 ppb of methylenechloride from Photo Circuits Corporation. No groundwater samples have been analyzed for dichloromethane because

*Also known as methylene chloride

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of State Health Department limited laboratory capability. It is recommended, now, that groundwater samples be collected and analyzed for dichloromethane. Photo Circuits Corporation is a large user of this substance. Miscellaneous drains in the vicinity of both industries, which empty into Cedar Swamp Creek, show small quantities of solvents. The source of these solvents warrants further investigation.

3. Past contamination cannot be attributed to any single industry because of changes in solvent usage, the industries themselves, and waste disposal practices.

4. The feasibility of purging the contaminated groundwater from the aquifer in the vicinity of Carney Street should be explored. This would include a hydrological investigation to determine the extent of contamination. Changes in water supply practices which may be required would include maximizing industrial pumpage and discharging of cooling water into Cedar Swamp Creek rather than groundwater recharging as presently required. The environmental consequences of further increasing solvent concentrations in Cedar Swamp Creek would also require investigation.

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Sheldon O. Smith
Sheldon O. Smith, P.E., M.C.E.
Deputy Director
Division of Environmental Services

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## SUMMARY OF SURVEY INSPECTIONS
## GLEN COVE INDUSTRIAL AREA

The industries located in the vicinity of the Carney Street wells were reinspected on December 6 and 12, 1977, by R. Zimmer and D. Bornholdt. The following report summarizes these inspection/interviews:

1. Osrow Products, 88 Hazel Street - Contact: L. Osrow

   There is no change in their chemical usage. They are not aware of any problems in the area. When asked about "Man Products", 100 Carney Street, Mr. Osrow said he had never heard of them dumping chemicals or solvents.

2. Pall Corporation, 30 Sea Cliff Avenue - Contact: S. Krakauer

   They do not presently use any of the chemicals found in the area wells. The building now occupied by Novelty Scenic Studio, 40 Sea Cliff Avenue had been used by IMS Machine Corp. Mr. Krakauer stated that he believes that they used both tetrachloroethylene and trichloroethylene and spilled/dumped waste solvents in their yard. The Telco Company was previously Eastern Heat Treatment Co., and they used both chemicals also.

   Mr. Krakauer, who is a chemical engineer, mentioned the possibility of a reservoir of these chemicals from past dumping practices could be in the ground and are leaking at a very slow constant rate due to its low water solubility. He said that in the past, industries including his company would and did dump these chemicals because they felt they were too volatile to cause a problem. He said usage of these chemicals by Pall Corp. was extensive until 1971 when the aircraft part of the Company was moved to Florida.

   The inspectors observed a very messy chemical storage shed at the rear of the property approximately 250 feet from the wells. No storage of trichloroethylene or tetrachloroethylene was noted. We intend to sample the soil in this area for volatile halogenated organics.

3. Photo Circuits, 31 Sea Cliff Avenue - Contact: W. Dubicki

   No change in information supplied in prior interviews. They use methylene chloride, 1,1,1 Trichloroethane, cellosolve acetate and n-butyle alcohol.

4. Hinkle & Finlayson (Harbor Fuel), 10 Sea Cliff Ave. - Contact: R. Booth

   No chemicals or solvents used in their operation. There was no evidence of spilled or dumped chemicals at time of inspection.

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5. Glen Cove Manufacturing, 18 Bridge St. - Contact: Secretary to Mr. Reizer

No chemicals or solvents used.

6. Glen Cove Fashions, 79 Hazel Street - Contact: Mr. LoMonaco

1,1,1 Trichloroethane used as a spot remover only. No indication of other chemicals or dumping.

7. August Thomson, 36 Sea Cliff Ave. - Contact: Mr. Schneider

No organic chemicals used, only inorganic cleaning chemicals used.

8. Keyco, 45 Sea Cliff Avenue - Contact: Mr. Lindberg

No chemicals or solvents used other than kerosine for cleaning truck parts.

9. Telco, 40 Sea Cliff Avenue - Contact: Mr. Burger

They use 1,1,1 Trichloroethane, dirty solvent is returned to supplier for reclaiming.

10. Zoomar, 55 Sea Cliff Avenue

Use small amounts of acetone, alcohol, and varnolene for cleaning lenses.

11. Slater Electric Company, 45 Sea Cliff Avenue

They use tetrachloroethylene in vapor degreasers. Significant amounts found in their sewerage effluent, but no evidence of dumping or ground contamination was indicated. They distributed a memo to all their personnel to be very careful with the use and disposal of all organic chemicals.

12. F & J Precision Tooling Co., 59 Sea Cliff Avenue

Small (60 gal/year) of cutting oils used, no other chemicals or solvents indicated.

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(3/29/78)

NASSAU COUNTY DEPARTMENT OF HEALTH
240 OLD COUNTRY ROAD
MINEOLA, N.Y. 11501

JOHN J. DOWLING, M.D., M.P.H.
COMMISSIONER

FRANCIS V. PADAR, P.E.
ASST. DEPUTY COMMISSIONER
DIV. OF ENVIRONMENTAL SERVICES

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# FINAL REPORT OF INVESTIGATION OF ORGANIC CONTAMINATION OF GROUNDWATERS GLEN COVE

April 6, 1978

## Background

In response to the closure of public water supply wells in Glen Cove, the Department conducted an investigation to identify the sources of contamination.

## Survey Program

During the period June 30 to July 26, 1977, a series of samples were collected for organic analysis from various locations in the vicinity of Carney Street and Seamans Avenue, including waste discharges, drains, groundwater and Cedar Swamp Creek. Several of the organic analyses were made at the E.P.A. Laboratories, the balance by New York State Health Department Labs. Additional samples were taken in August, 1977, of groundwater at Glen Cove Well No. 20, and the storm drain at Sea Cliff Avenue. Results of these analyses are attached to this report.

Over one hundred inspection/surveys were made of commercial/industrial sites in the Glen Cove area. The industrial facilities in the area of the Carney Street well field area including Sea Cliff Avenue, Hazel Street and Bridge Street, were surveyed for chemical usage and wastewater disposal methods during February and June 1977, and again in December 1977. Resurveys were made of twelve companies in this area, a summary of which is attached. The commercial area near the Seamans Avenue well was visited and those using solvents at this time were inspected.

## Discussion of Results

Only four companies in the Carney Street area were identified that use the halogenated organic solvents. Slater Electric Company and Photo Circuits Corporation, use solvents of the halogenated hydrocarbon type, as follows: Slater, 4500 gallons per year of tetrachloroethylene; and Photo Circuits, 71,000 and 11,200 gallons per year of dichloromethane (methylene chloride) and 1,1,1-trichloroethane, respectively. Slater Electric Company has issued a directive to all their personnel to control the use and disposal of solvents. None of these companies, however, use

## SAMPLING RESULTS OF GLEN COVE INDUSTRIAL AREA

| | Sample | Trichloro-ethylene ppb | Tetrachloro-ethylene ppb | Dichloromethane (Methylene chloride) ppb | 1,1,1 Trichloro-ethane ppb |
|---|---|---|---|---|---|
| 1. | Photo Circuits, treated effluent to sewer | 2.1 | 3.0 | 480 | ** |
| 2. | Photo Circuits, parking lot drain to stream | 30 | 23 | N.D. | ** |
| 3. | Glen Head drain at stream | 25 | 77 | N.D. | ** |
| 4. | Slater, effluent to sewer | 22 | 1210 | N.D. | ** |
| 5. | Sewage from industrial area | 4.7 | 43 | 440 | ** |
| 6. | Groundwater at Well #20 | 52 | 5.3 | N.D. | ** |
| 7. | Pall Corp. A/C recharge | 16 | 5.2 | N.D. | ** |
| 8. | Keyco truck wash area | N.D. | N.D. | N.D. | ** |
| 9. | Stream at Glen Head Country Club | <5 | <2.5 | ** | 5 |
| 10. | Stream at Carney Street | 115 | 12 | ** | 6 |

**Not analyzed or reported

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(8/31/77)

trichloroethylene which is the major contaminant of the wellwater in this area. The two smaller companies located both use small amounts of 1,1,1-trichloroethane as a cloth cleaner. One company admitted to dumping halogenated hydrocarbons in past years and indicated that others did the same. No present dumping/spilling was noted, either intended or accidental. Solvent waste discharges of significant magnitude from two of these industries are presently being discharged into the Glen Cove sewer system. These include 1200 ppb of tetrachloroethylene from Slater Electric Company and 480 ppb of methylene chloride from Photo Circuits Corporation.

The survey of the commercial area near the Seamans Avenue wells located two present users and one prior user of solvents. The present users are a gasoline/service station who has just started to use solvent cleaners and a dry cleaner using 3000 gallons/year of tetrachloroethylene. The prior user was also a drycleaning company who has since gone out of business.

Abatement action including litigation has commenced against a major polluter of ground and surface waters by organic chemicals in Glen Cove due to the combined efforts of the U.S. Coast Guard, New York State Department of Environmental Conservation and the Nassau County Department of Health.

## Conclusions

No present waste disposal practices were found which could account for the extent of contamination of the Carney Street well field, or the Seamans Avenue well. None of the companies presently use trichloroethylene. It, therefore, is concluded that the contamination of the Carney Street wellfield by trichloroethylene and tetrachloroethylene is due to past waste discharges originating in the Sea Cliff Avenue industrial area, possibly as recent as five to ten years ago. Past contamination cannot be attributed to any single industry because of changes in solvent usage, the industries themselves, and waste disposal practices. The groundwater in the area is generally contaminated with these solvents, with highest concentrations focused in this industrial area located 1,000 feet southeast of the Carney Street wellfield. The possible source of contamination of the Seamans Avenue well could not be indicated since the users are small and 3,000 feet away.

## Recommendations

The feasibility of purging the contaminated groundwater from the aquifer in the vicinity of Carney Street should be explored. This would include a hydrological investigation to determine the quantity and area of contamination. Changes in water supply practices which may be required would include maximizing industrial pumpage and discharge of cooling water into Cedar Swamp Creek rather than groundwater recharging as presently required. The environmental

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quences of further increasing solvent concentrations in
ar Swamp Creek would also require investigation.

- Groundwater samples should be analyzed for dichloromethane (methylene chloride) since this solvent is used in significant quantity in the Glen Cove industrial area. This is not presently analyzed for due to difficulties in laboratory procedure.

Marvin B. Fleisher, P.E.
Public Health Engineer
Chief, Organic Chemical Survey
Bureau of Wastewater Management

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Attachments

**REFERENCE 29**

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# Hydrogeology of Northwestern Nassau and Northeastern Queens Counties Long Island, New York

*By* WOLFGANG V. SWARZENSKI

GEOLOGICAL SURVEY WATER-SUPPLY PAPER 1657

*Prepared in cooperation with the Nassau County Department of Public Works and the New York State Water Resources Commission*

*With special reference to water in Cretaceous and Pleistocene aquifers*

UNITED STATES GOVERNMENT PRINTING OFFICE, WASHINGTON : 1963

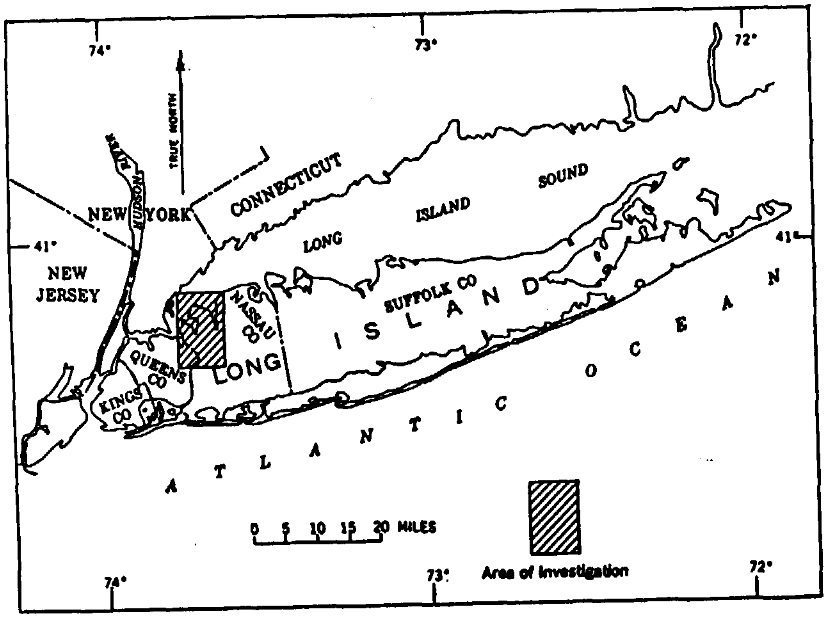


FIGURE 1.—Map of Long Island, N.Y., showing area of investigation.

Island was prepared by deLaguna and Brashears (1948). Records of wells, geologic-correlation tables, and data on ground-water withdrawals have been published in many of the bulletins of the New York State Water Power and Control Commission. (See "References cited.") Recent test drilling in southwestern Nassau County has yielded stratigraphic and lithologic information (Perlmutter and others, 1959), which also is applicable to the present report area, adjoining to the north. J. F. Hoffman and E. R. Lubke (written communication, 1959) have compiled chloride concentrations and ground-water temperatures for wells in Nassau County. U.S. Geological Survey Water-Supply Papers, containing water-level measurements and related hydrologic data for many of the observation wells, are listed in a report by Isbister (1959, table 3).

### ACKNOWLEDGMENTS

The writer wishes to express his appreciation to the generous assistance of well drillers and Water District superintendents in furnishing field data for this report. Records of test borings, water-level data and chemical analyses were made available by officials of the Nassau County Department of Public Works, Department of Health, and agencies of the State of New York. The writer is particularly indebted to W. Fred Welsch, Senior Engineer, Nassau County Department of Public Works, and Arthur H. Johnson, Associate Hydraulic Engineer, New York State Water Resources Commission (formerly New York State Water Power and Control Commission), for their generous and continued support of the investigation. The present report includes data collected by U.S. Geological Survey personnel and cooperating agencies during the course of many years. Published and unpublished information was used freely in an effort to solve the complex geologic and hydrologic problems of the report area. The work of earlier investigators is acknowledged.





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### WELL-NUMBERING SYSTEM AND MAP COORDINATES

Well numbers on Long Island are assigned in sequence by the New York State Water Resources Commission as information is obtained and have no bearing on location. The well numbers are preceded by a letter designating the county in which the well is located; thus, Q1293 refers to a well in Queens County, whereas N1293 is in Nassau County. As an aid in locating wells, the map area (well-location map, pl. 1) has been subdivided into 2½-minute rectangles, which are designated by number and letter in the indexed margins. The coordinates, given in all major tables of the report, designate the rectangle in which the well is located and indicate distances of the well in miles, first north, then west, from the southeast corner of that rectangle. Geologic and hydrologic data for wells shown on plate 1, but not published in this report, are available for consultation in the files of the Geological Survey office at Mineola, N.Y.

## GEOGRAPHY

### TOPOGRAPHY AND DRAINAGE

Long Island lies entirely within the Coastal Plain province of the northeastern United States. The area of investigation, on western Long Island, may be subdivided into three morphologic units; from north to south (1) the headlands, including Great Neck and Manhasset Neck, (2) the Harbor Hill terminal moraine, and (3) the glacial-outwash plain. (See pl. 8.) The headlands rise abruptly from Long Island Sound and its bays to rather uniform altitudes of 80 to 100 feet near their northern tips. Southward, the headlands, which are mantled thinly by glacial till, become increasingly irregular, being dissected by small streams discharging into the bays, to the east and west. Individual hills rise to altitudes above 200 feet. Within the project area, the headlands are indented by three major bays, Hempstead Harbor, Manhasset Bay, and Little Neck Bay. These bays have a general north-south orientation and are 3 to 5 miles in length. The Harbor Hill terminal moraine, consisting of a series of coalescing irregular hills, forms a pronounced ridge, trending to the northeast, Associated with the ice invasion are advance outwash, ice-contact deposits, and till, described collectively as Ronkonkoma drift (p. 45). Ice shove produced strong deformation of the Gardiners clay and older formations along the entire north shore of Long Island and locally incorporated large masses of these materials in the drift. The Ronkonkoma ice front subsequently retreated an unknown distance to the north of Long Island, then apparently readvanced to another position of relative stability marked by the Harbor Hill terminal moraine. Various outwash deposits and till (Harbor Hill drift, p. 46) are related to the advance, stagnation, and waning of the latest, or Harbor Hill, ice in the area. Glacial lakes were formed in some depressions along the north shore of Long Island during the wasting stages of both ice invasions. In post-glacial time erosion and deposition proceeded under conditions of fluctuating sea level. Recent sediments accumulated in some of the Pleistocene valleys and north-shore bays, and sea level rose to its present position in the most recent past.

## HYDROLOGY

### GROUND WATER

#### GENERAL FEATURES

The ultimate source of the ground water is precipitation. Of the total precipitation, part returns directly to the atmosphere, part infiltrates the ground, and part runs off overland in streams draining into Long Island Sound or the ocean. Much of the water moving downward into the soil and subsoil is retained at shallow depth as soil moisture, which is subject to evaporation and the demands of plant growth. During the summer, evapotranspiration may return moisture to the atmosphere at rates similar to or exceeding those of precipitation. During the remainder of the year, water available after the soil-moisture requirements have been met moves down through the Pleistocene and Cretaceous strata to the water table and becomes ground water. Some of the water eventually reaches the deeper strata by downward percolation—chiefly from the main area of recharge on the ground-water divide in the southeastern part of the project area and locally from areas of recharge on Manhasset and Great Necks. Ground water discharges by upward leakage from the deeper strata along the coast, offshore, in springs along the shores, and by ground-water outflow in the lower reaches of stream valleys.

Unconsolidated deposits of Cretaceous and Pleistocene age form the bulk of the ground-water reservoir. The intergranular space of all these deposits is saturated from the weathered bedrock upward to the water table, which represents the upper limit of the zone of saturation. Where the upper part of the zone of saturation is in permeable beds, ground water is unconfined or under water-ta[ble] conditions. Ground water confined under pressure beneath relati[vely] impermeable strata is called confined or artesian. The water m[ay] be under sufficient pressure to flow at the land surface, where tap[ped] by a well. Flowing wells are common near the shores of s[...] bays and harbors leading into Long Island Sound.

Ground water in the project area is under virtually all degree[s of] confinement, ranging from water-table to artesian. Also, locall[y] bodies of ground water are perched above the main water table an[d] separated from it by an intervening unsaturated zone. Ground wat[er] is perched where the downward migration of water is impeded by a relatively impermeable stratum, which results in a local zone of saturation unrelated to the main water table.

All the water in the ground-water reservoir can be considered to constitute a single hydraulic system, but the more permeable zones within the reservoir are called aquifers. An aquifer is a discrete hydrological unit that is capable of yielding water to wells or springs in substantial quantities; it may be comprised of one formation, part of a formation, or group of formations. Impermeable strata in the reservoir that confine or retard the flow of ground water are known as aquicludes or aquitards, respectively.

#### WATER-BEARING UNITS

In the project area, the ground-water reservoir includes three discrete aquifers which consist of parts of either one or two contiguous geologic formations. For identification and discussion, these are designated as the shallow unconfined, the principal, and the deep confined aquifers. In addition to these aquifers, local bodies of perched ground water also are discussed in following sections.

#### BODIES OF PERCHED WATER

Although bodies of perched water are found at several places in the northern part of the project area, they are not used as a source of water. Areas in which isolated bodies of perched water commonly occur are outlined in figure 5. Perched water occurs close to the land surface in depressions that are underlain by clayey till, particularly in the area of ground moraine north of the Harbor Hill terminal moraine. Perched-water zones also associated with till are common within the Harbor Hill and Ronkonkoma terminal moraines, which are shown in plate 8. A sheet of relatively impermeable older ground moraine from the Ronkonkoma terminal moraine northward to Manhasset Neck causes ground water to be perched, commonly several tens of feet below land surface, in that area. Isolated bodies of perched water are found in clay-bottomed kettle holes within the moraines, in the intermorainal area, and on the outwash plain slightly south of the moraines.

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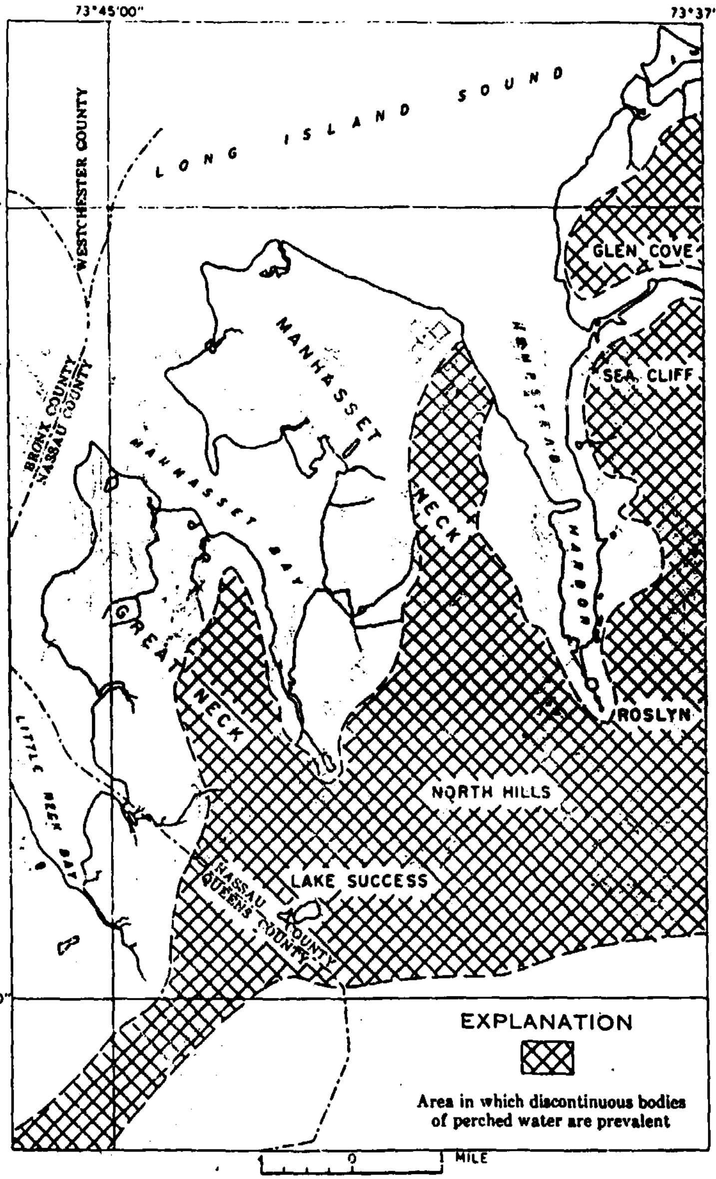


FIGURE 5.—Map of northwestern Nassau and northeastern Queens Counties, N.Y., showing areas of perched water.

### SHALLOW UNCONFINED AQUIFER

The shallow unconfined aquifer consists of those permeable Pleistocene and Cretaceous deposits that lie below the main water table and within the upper part of the zone of saturation, from slightly below to a little more than 110 feet above sea level. Contours on the main water table are shown in plate 9. The shallow unconfined aquifer is a source of water where it occurs in sand and gravel deposits, particularly in the glacial outwash plain south of the Harbor Hill terminal moraine. Owing to the irregular distribution of Cretaceous clay and other beds of low permeability within the aquifer in the vicinity of Kings Point and Port Washington, the water-bearing materials in these area are more discontinuous than elsewhere. Nevertheless, small supplies of water are obtained from the aquifer for domestic and industrial purposes in many parts of the Manhasset and Great Neck peninsulas. Also, of considerable importance as sources of water are the permeable deposits in the shallow aquifer in northeastern Queens County and in Sands Point, beyond the northern limit of the principal aquifer—that is, in areas where these deposits lie directly above the clay member of the Raritan formation or the Gardiners clay. In 1957, about 5 mgd (million gallons per day) of ground water was withdrawn from the shallow unconfined aquifer in the project area.





### PRINCIPAL AQUIFER

The principal aquifer corresponds approximately to that part of the Magothy(?) formation which occurs from about 50 feet below sea level downward to the top of the clay member of the Raritan formation. In places, moreover, the aquifer includes Pleistocene deposits which blanket the Magothy(?) or lie in channels cut into it. Some pre-Wisconsin channels, which cut to or slightly into the clay member of the Raritan formation and are filled with undifferentiated Pleistocene deposits, have been noted (pls. 4–7), and other channels undoubtedly exit in the area. The channel fill is generally of coarser texture than the adjacent Magothy(?) deposits with which, however, it is hydraulically continuous. The areal extent of the principal aquifer is indicated in plate 10. The principal aquifer terminates in the center of Great and Manhasset Necks, somewhat south of the northern limit of the Cretaceous deposits shown in plate 3. The presence of the clay member of the Raritan formation near sea level and the truncation of the Magothy(?) by erosion limit the extent of the principal aquifer northward (pl. 10). Beyond this limit, the principal aquifer merges with the shallow unconfined aquifer.

Hydrostatic heads in the principal aquifer are commonly from a foot to several feet below those in the shallow unconfined aquifer, except in the Port Washington area, where they are as much as 85 feet lower. Hence, the principal aquifer can receive water by downward movement through permeable and relatively impermeable zones, which include discontinuous clay lenses of both the Magothy(?) and the Pleistocene. Although hydraulic continuity between the shallow unconfined aquifer and the upper part of the principal aquifer, is fairly good locally, artesian conditions generally prevail in the deeper part of the principal aquifer. The principal aquifer is the chief source of water in most of the project area, except the peninsulas. In 1957 about 28 mgd was withdrawn from wells screened in the basal zone of the Magothy(?) formation and other permeable zones in the Magothy(?) and deeper Pleistocene deposits.

#### DEEP CONFINED AQUIFER

The deep confined aquifer consists of the Lloyd sand member of the Raritan formation and the Jameco gravel and underlies the entire project area. The lower limit of the aquifer is the bedrock surface; the upper limit is the clay member of the Raritan formation and the Gardiners clay. The Gardiners clay may abut the clay member on the north, where the deposits of Cretaceous age have been eroded, or it may lie directly upon the clay member, as it does in some valleys and embayments. Thus, the Lloyd sand member of the Raritan formation (Cretaceous) and the Jameco gravel (Pleistocene) are connected hydraulically in the northern part of Manhasset and Great Necks. The two contiguous clay bodies overlying the aquifer, the clay member of the Raritan formation and the Gardiners clay, form effective confining beds, which probably extend beyond the shoreline of the project area. These stratigraphic relations are shown in three geologic sections (pls. 4–6). The vertical limits of the deep confined aquifer are shown on the hydraulic profile (pl. 12).

As hydrostatic heads in the deep confined aquifer (pl. 11) are commonly from 5 to 50 feet lower than those in overlying aquifers, downward leakage of water from the shallow unconfined and principal aquifers through the clay member of the Raritan formation and the contiguous Gardiners clay is possible in most of the area.

Hydraulically, the deep confined aquifer is the most perfectly confined of the water-bearing units. The degree of confinement is demonstrated by the fact that interference effects in the aquifer are recognized from centers of pumping as much as 10 miles away from the project area. In contrast, the effects of pumping on the principal and shallow unconfined aquifer generally are observed only within a radius of less than half a mile from pumped wells. The deep confined aquifer is a major source of water in the northern part of the project area, particularly on Manhasset and Great Necks. Locally, it is the only source available for large public supplies or industrial needs. About 7 mgd was withdrawn from the aquifer in 1957.

#### THE WATER TABLE AND PIEZOMETRIC SURFACES

Hydrostatic pressures in each of the aquifers in the project area can be related to a water table or associated piezometric surfaces.





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The shape and slope of these surfaces are determined chiefly by the thickness, areal extent, and permeability of the aquifer materials and the quantity of water moving through them. Moreover, each surface expresses a dynamic equilibrium among all factors affecting recharge and discharge relationships, both natural and artificial, within the aquifer. Variations in any one of the factors may produce changes in the position of the surface and concomitant changes in storage and pressure in the aquifer and adjacent aquifers.

The configuration of the water table, which marks the top of the shallow unconfined aquifer, is shown in plate 9 by contours referred to sea level and is based on water-level measurements made in wells during April 1957. From figure 14 it is apparent that a high position, which is also on the main water-table divide of Long Island, lies in the Albertson-East Williston area about 2½ miles south of the Harbor Hill terminal moraine. (Position of moraine shown on pl. 8.) Along this divide, which occurs in relatively permeable outwash deposits, the water table reaches altitudes of 75 to 80 feet above sea level. The water table slopes from the divide area to the northwest, west, and southwest, at gradients of about 5 to 6 feet per mile near the divide, steepening to about 10 feet per mile toward the southwest. In the southern parts of Manhasset and Great Necks, there is a pronounced flattening in the northwesterly slope from the main divide, and near the margins of Little Neck and Manhasset Bays and Hempstead Harbor (pl. 9) the water table assumes steep bayward gradients of 25 to 35 feet per mile. The shape of the water table in the central and northern parts of Manhasset and Great Necks is controlled essentially by local recharge and geologic conditions. More or less isolated ground-water mounds are indicated by closed water-table contours above an altitude of 25 feet on Great Neck and 60 feet on Manhasset Neck. Although the presence of these mounds is favored by the topography of the peninsulas, the high position of the water table is largely the result of zones of low permeability within the zone of saturation. Thus, water-table altitudes of more than 110 feet on Manhasset Neck are due to the presence within the upper part of the ground-water reservoir of rather impermeable till zones and Cretaceous deposits, the latter occurring as buried erosional remnants and ice-shoved masses. Sharply defined troughs in the water table around Little Neck and Manhasset Bays and Hempstead Harbor, and the fact that water-table contours are restricted to land areas, indicate that the shallow unconfined aquifer terminates at the shore lines of these salt-water bodies where ground-water is discharged.

The piezometric surface of the principal aquifer based on measurements in observation wells in April 1957 is shown in plate 10. The shape and slope of the piezometric surface is generally a somewhat subdued replica of the water table (pl. 9). The pronounced mound in the water table on Manhasset Neck is apparently reflected by a ground-water nose in the piezometric surface somewhat west of the high point on the mound. Also, pumping centered around well N2030 has created a marked cone of depression, indicated by the 25-foot depression contour in the piezometric surface, and has locally distorted the shape of the ground-water nose. Troughs in the piezometric surface are focused on Manhasset Bay and Hempstead Harbor and indicate direct ground-water discharge from the principal aquifer to these salt-water bodies. However, in contrast to the shallow unconfined aquifer, the piezometric surface shows that the principal aquifer probably extends beneath the southern parts of these bays but terminates somewhat farther north near the limit of the aquifer, as indicated in plate 10.

The piezometric surface of the deep confined aquifer in April 1957, as shown in plate 11, is based on measurements made 8 to 12 hours after cessation of pumping in most wells tapping this aquifer in the project area. Owing to rapidly changing heads within this aquifer that are caused by pumping, it is difficult to depict a representative piezometric surface. However, the piezometric surface presented in figure 16 may be generally representative for average daily recovery of water levels during most of the year, when withdrawals from the aquifer in the project area average about 6 to 7 mgd. Withdrawals during the summer are considerably larger, as much as 14 mgd in July 1955, and the piezometric surface in July 1955 undoubtedly was markedly different from that shown in figure 16. Depression contours on plate 11 indicate, somewhat schematically, the larger public-supply and industrial pumping centers that were in operation during the spring of 1957. The cones of depression are indicative of partial recovery of water levels after pumping; their gradients and lateral extent vary from day to day, according to the rates of antecedent pumping and the particular combinations of pumping wells. Although the natural shape of the piezometric surface is distorted by pumping effects, it is apparent from plate 11 that the general slope of the surface is westerly—declining from an altitude of somewhat more than 20 feet on the east side of the project area to less than 4 feet on the southwest. Thus, across the project area, the average gradient is about 2 to 3 feet per mile. The closed 14-foot contour in the south-central part of Great Neck may reflect local recharge by downward leakage from the principal aquifer or possibly may be a residual high, comparatively unaffected by nearby pumping. Also the pronounced noses on the piezometric surface in the northern parts of Manhasset and Great Necks presumably indicate local areas of downward leakage from the





shallow unconfined aquifer. On the west side of Manhasset Neck is a cone of depression, marked by a re-entrant in the 2-foot contour, in which the piezometric surface has been depressed by pumping to positions considerably below sea level. This situation, of course, is conducive to salt-water encroachment from Manhasset Bay into the deep aquifer. As indicated by the piezometric contours, the deep confined aquifer extends beneath all the land area of the project and probably also beneath Little Neck Bay, Manhasset Bay, and Hempstead Harbor.

### RECHARGE

The ground-water reservoir in the project area is replenished under natural conditions solely by precipitation, which in Nassau County averages about 43 inches annually. Of this, perhaps 50 percent reaches the water table at an average recharge rate in Nassau County equivalent to about 1 mgd per square mile. This rate of recharge is probably high for the northern part of the project area, where the relatively steep topography, near-surface till, and Cretaceous clay impede infiltration and increase overland runoff. Thus, recharge to the water table within the project area (63 square miles) may be little more than 55 mgd. Even under optimum conditions, recharge to the water table is chiefly dependent upon precipitation during the season when plant growth is dormant. The infiltration from summer rains is to a large extent intercepted by growing plants, and ground-water replenishment may be negligible during the growing season. Normally, precipitation in Nassau County is fairly evenly distributed throughout the year.

The principal and deep confined aquifers are replenished entirely by downward percolation of water from the shallow unconfined aquifer through the more permeable zones within confining clay bodies and even, directly but slowly, through the clay. Whereas recharge areas for the principal aquifer coincide generally with areas of high water table in the shallow aquifer and flow directions in both aquifers are similar, water in the deep confined aquifer, particularly in the Lloyd sand member of the Raritan formation, apparently originates chiefly in eastern Nassau County—mostly east of the project area. However, the deep confined aquifer also receives local increments of recharge within the project area, as indicated by the contours on its piezometric surface (pl. 11) in Manhasset and Great Necks.

Recharge to the deep confined aquifer through the confining clay may be estimated by application of a modified equation expressing Darcy's law:

$$Q=PIA$$

in which $Q$ is the discharge in gallons per day; $P$ is the coefficient of permeability, in gallons per day per square foot; $I$ is the hydraulic gradient in feet per foot; and $A$ is the cross-sectional area in square feet through which the discharge occurs. Assuming permeabilities of 0.001 to 0.1 for the clay and a head loss of 50 feet through 200 feet of clay, the following recharge rates can be computed:

| *Permeability* | *Recharge (gpd per sq mi)* |
|---|---|
| P 0.001 | 7,000 |
| .01 | 70,000 |
| .1 | 700,000 |

These values, of course, give only possible orders of magnitude for rates of recharge to the deep confined aquifer. They also indicate that the rates may range between wide limits, depending on permeability.

Natural infiltration of precipitation in parts of Nassau County has been disrupted by the growth of densely populated and industrialized areas. The problem of disposing of storm waters from impervious paved areas has been solved by the construction of short storm-sewer lines terminating in recharge basins. Of Nassau County's 425 recharge basins constructed since 1935, about 65 are within the project area. Most of these are south of Northern Boulevard (pl. 1) in populated areas which lack natural drainage channels. Their designed storage capacity is determined by the area to be drained; the basins are commonly 12 to 15 feet deep and range in size from less than 1 to several acres. Storm water seeps from these basins through the underlying sand and gravel deposits to the water table, thereby providing artificial replenishment of the ground-water reservoir. Inasmuch as drainage in much of the project area is poor, some of the basins merely serve as collecting points for storm water, which may ultimately reach a more favorably situated basin by means of overflow drains. Seepage rates from each basin vary according to natural permeabilities of the underlying material, maintenance of the basin, antecedent precipitation, temperature, and head of the collected waters. In an experimental recharge basin near Mineola, infiltration rates ranging from 20 to 400 gpd per square foot under various conditions were determined by the Surface Water Branch of the U.S. Geological Survey (Brice and others, 1959).

Artificial recharge to the water table also is effected by means of cesspools and septic tanks. Thus, perhaps 15 mgd or about half the water pumped for public supply in the project area in 1957 was returned to the ground, while about 15 mgd was discharged as treated sewage directly to Long Island Sound and the ocean. However, the expansion of sanitary sewers discharging to tidewater may eventually eliminate this source of ground-water replenishment. As required by law, most of the ground water pumped in Nassau County for industrial and cooling purposes is returned to the ground by sumps and diffusion





wells. Thus, 18.0 mgd or 75 percent of the total industrial pumpage in Nassau County (24.3 mgd) was returned to the ground-water reservoir in 1957. Of 18.0 mgd, it is estimated that about 6 mgd was returned to the ground in the project area.

### MOVEMENT

Ground water moves along flow lines from points of high head to points of low head. The rate of movement depends upon the permeability of the materials in the reservoir and relative differences in head. The bulk of ground-water flow in an aquifer is in the direction of the steepest gradient and normal to contour lines, as shown on the water-table (pl. 9) and piezometric maps (pls. 10, 11); yet there may be minor flow components oblique to the principal flow direction. In the shallow unconfined aquifer, most of the water moves from the main water-table divide in the Albertson-East Williston area toward the northwest, west, and southwest (pl. 9). However, in the southern parts of the Manhasset and Great Neck peninsulas, much of the northward and northwestward flow from the main divide is intercepted and diverted laterally by east-west valleys, such as those of the Cutter Mill and Flower Hill drains, that cross the peninsulas. Each of these peninsulas contains a well-developed ground-water mound in the shallow aquifer, and from these mounds the shallow ground water flows radially outward to bounding salt-water bodies. However, from the apices of both mounds, most of the flow apparently is westward because of masses of rather impermeable Cretaceous deposits at altitudes of 50 to more than 100 feet along the eastern margins of both peninsulas.

Ground-water flow in the principal aquifer (pl. 10) is generally westward and northward—similar to that in the shallow unconfined aquifer but not coinciding everywhere. In the area of the main ground-water divide, pressure heads in the principal aquifer are a foot to a few feet lower than the water table, and water moves downward from the shallow aquifer into the principal aquifer. A head difference of approximately 5 feet between the water table (well N1140) and the basal zone of the principal aquifer (well N575) has been observed in Garden City (pl. 12). The vertical interval between the screens of wells N575 and N1140 is about 460 feet, which is the maximum known interval in the project area between the two aquifers. In parts of Port Washington on Manhasset Neck, heads in the principal aquifer are as much as 85 feet lower than those in the shallow aquifer (pls. 9, 10). As little downward movement of water from the shallow unconfined aquifer seems possible in this area because of highly impervious clay bodies, the principal aquifer apparently receives water almost entirely by flow from the south.

Pressure heads in the principal aquifer in an area peripheral to the southern parts of Manhasset Bay and Hempstead Harbor are commonly higher than the water table and also higher than the heads in the deep confined aquifer. Thus, water in this area can move upward into the shallow aquifer or into salt-water bodies as well as downward into the deep confined aquifer. The pressure relationships of shallow, principal, and deep aquifers at the southern ends of Little Neck Bay, Manhasset Bay, and Hempstead Harbor are shown in figure 6. Pressures in the principal aquifer, above the clay member of the Raritan formation, are generally 6 to 10 feet higher than the water table at corresponding sites. At the southern end of Hempstead Harbor, exceptionally high heads, resulting from recharge to the strata above the clay member from the surrounding high ground, have been observed. At a depth of 12 feet below the land surface, pressures are 10 feet above the land surface, and at the base of the principal aquifer (260 feet below the land surface), pressures are about 20 feet above the surface (see fig. 6).

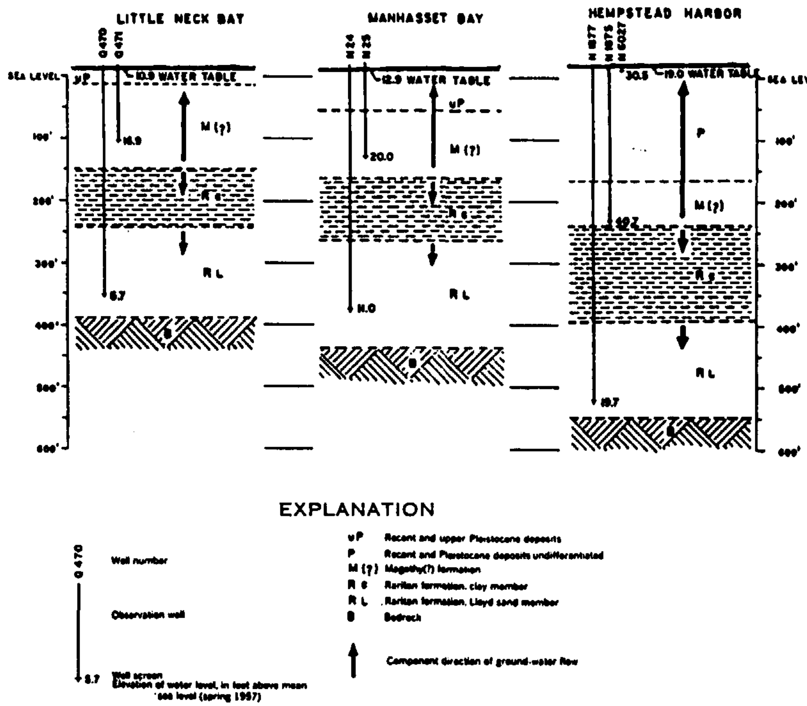


FIGURE 6.—Pressure relationships in shallow and deep wells at selected sites on Little Neck Bay, Manhasset Bay, and Hempstead Harbor, Long Island, N.Y. (1957).





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Under natural conditions, the bulk of the water in the deep confined aquifer moves westward across the project area (pl. 11). However, a northerly component flows across Manhasset and Great Necks and Hempstead Harbor toward Long Island Sound. South of the northern limit of the principal aquifer (pl. 10), pressure heads in the deep confined aquifer are commonly from a few feet to as much as 50 feet lower than those in the principal aquifer and water moves downward. North of this limit, in the northern part of Manhasset and Great Necks, the water table in the shallow unconfined aquifer is generally 5 to 20 feet higher than pressure heads in the deep confined aquifer, and water moves downward from the shallow to the deep aquifer.

Movement of water in the vertical plane through the ground-water reservoir is demonstrated in a hydraulic profile from Sands Point to Garden City (pl. 12). This profile serves to indicate the relationships of the aquifers, chief confining strata (aquicludes), pressure heads, and principal areas of recharge and discharge. Water levels and piezometric heads are given as of April 1957 and reflect, where measured in supply wells, average recovery periods of 8 to 12 hours after pump shutdown. The line of the profile, shown on plate 9, was chosen to show principal head relationships and flow directions in a typical vertical section through the ground-water reservoir. Inasmuch as flow directions in the shallow, principal, and deep aquifers do not coincide entirely in any one plane of section, some oblique-flow components are necessarily included and labeled as such. Also, the hydraulic profile shows the traces of equipotential surfaces where these are intersected by the line of profile.

### DISCHARGE

Ground water is discharged naturally by evapotranspiration, coastal springs, submarine discharge into the salt-water bodies, and effluent seepage into streams that drain into Long Island Sound. Also, water is discharged artificially by withdrawals from wells.

Losses from the zone of saturation through evaporation and transpiration vary seasonally and depend in large degree on the position of the water table with respect to the land surface. In areas where the water table is close to the land surface, moisture is returned to the atmosphere by evaporation from the soil zone and by the transpiration of plants whose roots tap the water table or the capillary fringe above it. Thus, high evapotranspiration rates prevail in some meadow lands, alluvial deposits, and swampy areas, particularly along the north shore and on Great and Manhasset Necks (see pl. 8). Evaporation from the land and from floating pans in the Mineola area, determined by the Surface Water Branch of the U.S. Geological Survey, ranged from 24.53 to 28.08 inches for 7-month periods (April–October) in 1949, 1950, and 1951, exceeding precipitation by about 1 to 4 inches during these periods (Brice, and others, 1959, p. 31).

Along approximately 42 miles of coastline in the area, springs at many places discharge at the edge of salt water and also below sea level. Springs are particularly common in areas where Cretaceous Clay occurs above sea level, as on the east shore of Hempstead Harbor, north and south of Glen Cove. Discharge from individual springs, where it can be observed, is generally from 2 to 10 gpm, rarely more. From a survey it is estimated that the total discharge from springs along 42 miles of coastline may be as great as 2 to 3 mgd. Although no accurate estimate of its magnitude can be given, the bulk of this discharge presumably comes from the shallow unconfined aquifer. In addition, ground water is discharged offshore by upward leakage from the principal and deep unconfined aquifers. Discharge by submarine springs and seepage is undoubtly considerable.

Considerable quantities of ground water are discharged by effluent seepage into stream channels, where these intersect the water table. The total base flow of streams in the project area was estimated to average about 15 mgd in 1957. The characteristics of the effluent streams of the project area are described more fully in the section on "Surface water."

Ground water is discharged artificially by withdrawals through pumping or flowing wells. In 1957 withdrawal from wells for all purposes within the project area was about 40 mgd. Pumping by public-supply systems in the Nassau County part of the project area alone accounted for 30 mgd. Of the water withdrawn, it is estimated that sewage-disposal plants in the long established north-shore villages deliver 9 to 10 mgd to the tidewater of Long Island Sound. In addition, the municipal sanitary-sewer systems of Mineola, Garden City, and parts of New Hyde Park are estimated to discharge 4 to 5 mgd, or possibly more, into the Nassau County trunk system that carries sewage to a treatment plant in Bay Park and ultimately to the ocean. The disposal of treated sewage at tidewater constitutes a net loss of about 15 mgd from the report area. This loss will increase as Nassau County's Sewage Disposal District No. 2 is extended northward into New Hyde Park and Williston.

#### WATER LEVEL FLUCTUATIONS

Fluctuations of water levels in wells screened in the shallow unconfined aquifer generally reflect changes in ground-water storage, but those in wells screened in the principal and deep confined aquifers reflect changes in artesian pressure. Water levels in most shallow wells in Nassau County fluctuate from 1 to 4 feet per year as the result of variations in natural recharge and discharge. Normally, water levels decline as the growing season progresses, from about





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May to November, and rise in response to ground-water replenishment during the winter and spring. A hydrograph of the average water level in 14 selected shallow wells in Nassau and Suffolk Counties, shown in figure 7, indicates seasonal fluctuations and long-term trends in response to precipitation. This hydrograph, representative of average ground-water conditions in the shallow unconfined aquifer, is compared with hydrographs of four shallow observation wells in the Mineola-New Hyde Park area (fig. 7). Deficient precipitation during 1956–57 is shown by unusually low water levels in all wells at the end of 1957. However, the average water level in the 14 shallow wells returned nearly to normal during 1958, whereas the water level in wells N1104, N1125, and N1138 had only partially recovered during that time. It appears likely that the water table is declining in the densely built-up areas represented by these wells—possibly as a result of increased pumping or loss of former sources of recharge occasioned by the expansion of centralized sewage-disposal systems that discharge effluent directly to the sea rather than into the ground. However, the period of the observed decline is as yet too short to draw definite conclusions. Declining water levels are noted also in the hydrograph of observation well N1479, in Great Neck (fig. 8). An overall decline of about 3 to 4 feet since 1949 is attributed to industrial pumpage ½ to 1 mile south of the well. The decline of water levels in this instance is aggravated by the diffusion of spent cooling water through wells that are screened above perching strata, whereas the withdrawals are made from deeper zones in the shallow unconfined aquifer. Much of the returned water in this area probably discharges directly to Little Neck Bay without reaching the main water table.

The normal seasonal trend of declining water levels in the shallow aquifer during the summer may be reversed by exceptionally heavy rainfall, as, for example, during the hurricanes of August 1955. For that month a total of 15.73 inches of rain was recorded at Mineola, with 12.78 inches falling in the period August 11–14. An almost instantaneous and sustained recovery of water levels is noted not only in most of the water-table wells but also in wells screened in the shallower artesian zones of the principal aquifer (N2635, from continuous water-stage recorder, fig. 8).

The daily water-level record during 1955 and 1956 of two observation wells screened in the deep confined aquifer, N5530 in Port Washington and N4266 in Great Neck, is shown in figure 9. Both observation wells indicate pressure trends in the deep confined aquifer in the two peninsulas, even though there are daily fluctuations of several feet which represent interference by public-supply well N3443 in Great Neck and wells N1715, N1716, and N4859 in Port Washington.

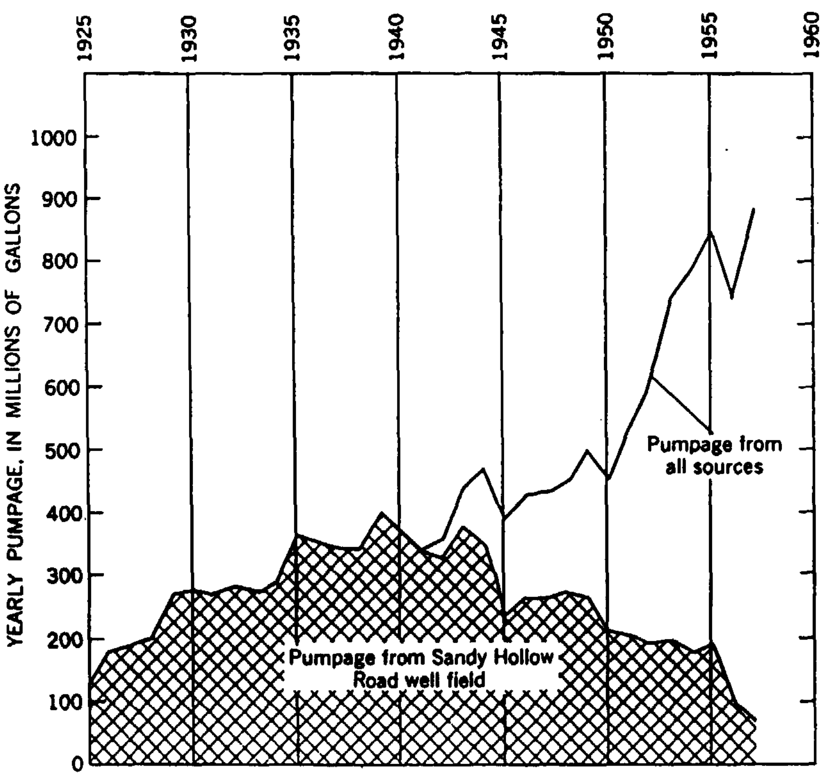


FIGURE 13.—Diagram showing yearly total pumpage by Port Washington Water District and withdrawals from well field at Sandy Hollow Road, Port Washington, N.Y. (1925-57).

13 ppm at N1926 in Kings Point, and 15 ppm at N906 in Sea Cliff (tables 14 and 15).

## SURFACE WATER

The surface-water bodies of the project area, a few small streams, some ponds, and large bodies of salt water connected with Long Island Sound, are treated briefly. The following discussions are restricted to streamflow characteristics and to the chemical quality and temperature of surface-water bodies that are related to the ground-water features of the area.

### STREAMFLOW CHARACTERISTICS

Inasmuch as the major drainage divide, the Harbor Hill terminal moraine, is close to the north shore in the project area, the streams discharging into Long Island Sound have short courses, usually less than 3 miles. The bulk of the streamflow represents ground-water discharge in the lower reaches of valleys where the water table intersects the land surface. Base flow of the larger streams discharging



Ref. 29
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into Hempstead Harbor, Manhasset Bay, Little Neck Bay, and Long Island Sound is generally less than 3 cfs (cubic feet per second; 1 cfs=646,317 gpd). Gaging-station records generally show that the streams have a large degree of uniformity of base flow throughout the year. However, they also show short-term peaks in flow due to overland runoff after storms and long-term fluctuations due to seasonal changes in ground-water storage. The only stream in northwestern Nassau County whose discharge is being gaged by a continuous water-stage recorder is Cedar Swamp Creek. This stream is considerably larger than the others in the area, as it has an average discharge of 7.40 cfs for the period of record (1938–55). Its course of about 4 miles follows a relatively broad north-south valley from Greenvale to Glen Cove, where it turns westward toward Hempstead Harbor. Streamflow is sustained by perched ground water and ponds in the Greenvale and Glen Head area. However, effluent seepage from the main ground-water body increases the discharge of the stream considerably in its lower reaches near Glen Cove. Daily discharge of Cedar Swamp Creek, from records of the Surface Water Branch of the U.S. Geological Survey, has been reported by R. M. Sawyer (1958). In the same report, the author discusses precipitation-runoff relationships and other factors affecting streamflow in Nassau County.

A summary of discharge measurements of the larger coastal streams within the project area is presented in table 8. All measurements were made by the Surface Water Branch; the location of gaging stations is shown in figure 14. Although the discharge measurements given in table 8 are only partial, they are representative of the relative rank of the north-shore streams. One of the major tributaries to Leeds Pond, the Plandome-Port Washington drain, was gaged at two stations (G and H, fig. 14) on December 28, 1956. In a distance of 3,200 feet, streamflow increased from 0.31 to 0.69 cfs (table 8); the increment represents lateral ground-water flow from the east.

In addition to the streams that have been gaged, there are a few smaller creeks, some of intermittent flow, where the discharge is estimated to range from about 0.2 to 0.5 cfs. The combined runoff by gaged and ungaged streams within the project area in 1957 was estimated to be 23 cfs, or 15 mgd.

### CHEMICAL QUALITY AND TEMPERATURE

The salinity of waters from Long Island Sound bays, and harbors varies considerably according to season and location of sampling points. Salinity and temperature data for several tide stations on Long Island Sound are given in Special Publication nos. 278 and 279 of the U.S. Department of Commerce, Coast and Geodetic Survey.

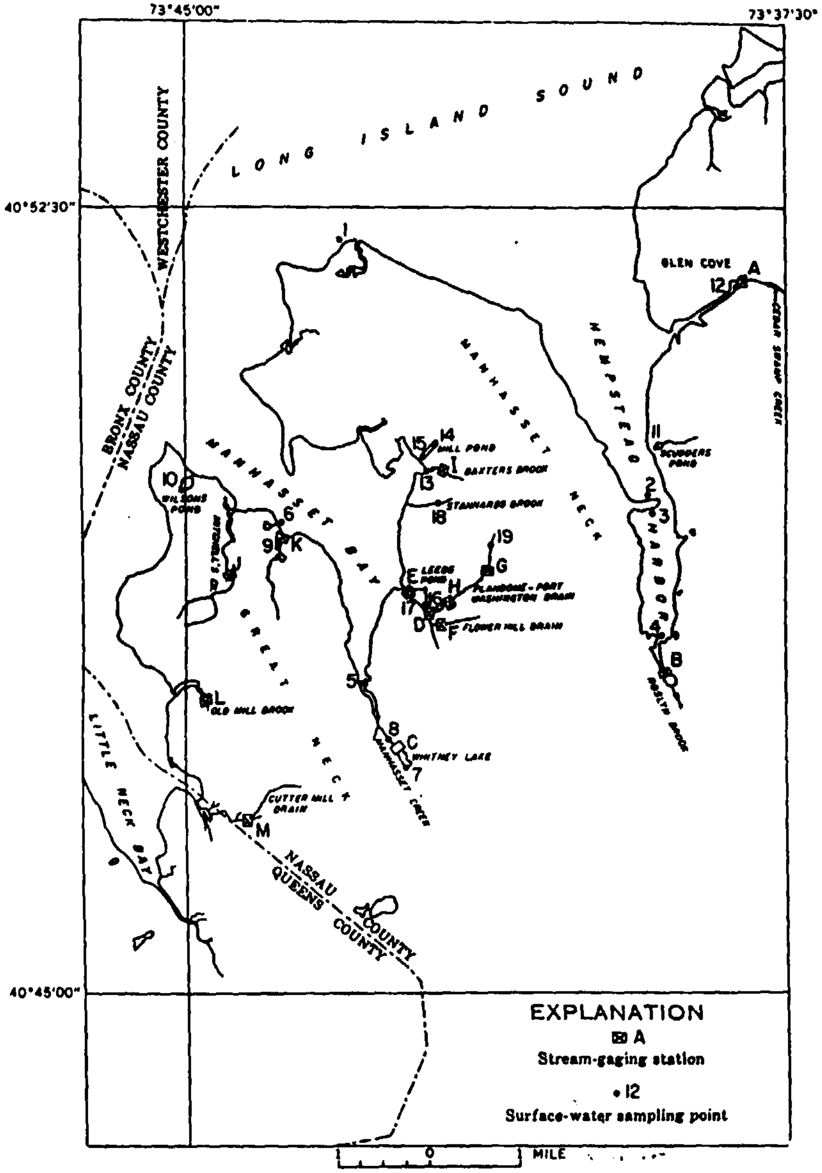


FIGURE 14.—Map showing location of stream-gaging stations and surface-water sampling points.





TABLE 8—*Stream-discharge measurements in northwestern Nassau County, N.Y.*

[Measurements by Surface Water Branch, U.S. Geol. Survey]

| Location (fig. 14) | Stream | Type of record | Discharge (cfs) |
|---|---|---|---|
| A | Cedar Swamp Creek at Glen Cove. | Water-stage recorder Average 1938–55. | 7.40 |
| B | Roslyn Brook at Roslyn | Periodic measurements Average 1953–57. | 2.56 |
| C | Whitney Lake outlet at Manhasset. | Periodic measurements Average 1953–57. | 2.90 |
| D | Leeds Pond inlet at Plandome | Discharge measurement January 15, 1953. | 1.03 |
| E | Leeds Pond outlet at Plandome | Discharge measurement December 28, 1956. | 2.46 |
| F | Flower Hill drain, at site of village of Plandome Public Water Supply. | Discharge measurement December 28, 1956. | .51 |
| G | Plandome-Port Washington drain at site of Port Washington incinerator. | Discharge measurement December 28, 1956. | .31 |
| H | Plandome-Port Washington drain 300 ft. west of culvert under railroad embankment at Plandome Country Club. | Discharge measurement December 28, 1956. | .69 |
| I | Baxters Brook, at Baxter Estates, Port Washington. | Discharge measurement | .55 |
| J | Mitchell's Creek, near Kings Point. | Discharge measurement January 15, 1953. | .86 |
| K | Unnamed creek, flowing north near Kings Point. | Discharge measurement March 12, 1957. | .82 |
| L | Old Mill Brook at site of sewage-treatment plant, Great Neck. | Discharge measurement January 15, 1953. | .39 |
| M | Cutter Mill drains, 40 ft upstream from culvert under railroad embankment, Great Neck. | Discharge measurement March 12, 1957 | 1.39 |

(See "References cited.") Comparatively uniform salinity prevails throughout the year at the Willets Point tide station, where the mean (1932–52) monthly salinity ranges only from 24,100 to 25,900 ppm. At the same station, the mean (1932-50) surface-water temperature ranges from 33.7°F in February to 71.7°F in August. For the same period of record, a mean annual temperature of 52.5°F is reported (U.S. Dept. Commerce). Considering a time lag of about 1 month, water temperarure agrees closely with observed mean monthly air temperature.

A complete chemical analysis of water from Long Island Sound, collected off Prospect Point, is given in table 9. The chloride concentration of 15,700 ppm is slightly less than that of a sample from the Atlantic Ocean (table 9). Chloride content from several water samples taken in Hempstead Harbor and Manhasset Bay ranged from 12,300 to 14,400 ppm (table 10). These values indicate fairly constant salinity in the bays and harbors and only minor fluctuations due to tidal stage.

TABLE 9.—*Chemical analyses of water from Long Island Sound and Atlantic Ocean*

[Analyses by U.S. Geol. Survey; chemical constituents in parts per million]

| Constituent | Long Island Sound [1] | Atlantic Ocean [2] |
|---|---|---|
| Silica ($SiO_2$) | 3.5 | 1.2 |
| Iron (Fe), total | .09 | 1.3 |
| Manganese (Mn), total | .02 | .00 |
| Calcium (Ca) | 346 | 351 |
| Magnesium (Mg) | 1,050 | 1,190 |
| Sodium (Na) | 8,730 | 9,520 |
| Potassium (K) | 327 | 373 |
| Bicarbonate ($HCO_3$) | 113 | 129 |
| Carbonate ($CO_3$) | 0 | 0 |
| Sulfate ($SO_4$) | 2,120 | 2,290 |
| Chloride (Cl) | 15,700 | 17,200 |
| Fluoride (F) | 1.1 | .0 |
| Nitrate ($NO_3$) | 1.0 | 1.1 |
| Dissolved solids: | | |
| Sum | 28,300 | 31,000 |
| Residue on evaporation at 180°C | 29,600 | |
| Hardness as $CaCO_3$ | 5,190 | 4,770 |
| Noncarbonate | 5,090 | 5,660 |
| Specific conductance (micromhos at 25°C) | 41,600 | 47,100 |
| pH | 7.1 | 7.6 |
| Color | 5 | 3 |
| Density at 20°C | 1.017 | 1.019 |
| Temperature (°F) | 60 | 43 |

[1] Collected off jetty at Prospect Point, Sands Point, N.Y., Oct. 22, 1957, near high tide.
[2] Collected off jetty at Atlantic Beach, N.Y., Apr. 18, 1956, near high tide.

TABLE 10.—*Chloride analyses of surface water in northwestern Nassau County, N.Y.*

[Analyses by U.S. Geological Survey]

| Sampling point (fig. 14) | Location | Date | Chloride (ppm) | Remarks |
|---|---|---|---|---|
| 1 | Long Island Sound; Jetty off Prospect Point | Oct. 22, 1957 | 15,700 | Near high tide. |
| 2 | Hempstead Harbor; Town Dock, Bar Beach | Mar. 15, 1957 | 14,400 | Do. |
| | | Mar. 11, 1957 | 12,700 | Near low tide. |
| 3 | Hempstead Harbor; south shore of Bar Beach | Mar. 15, 1957 | 14,150 | Near high tide. |
| | | Mar. 11, 1957 | 12,850 | Near low tide. |
| 4 | Hempstead Harbor; off Roslyn Terminal Pier | Jan. 11, 1957 | 12,300 | Do. |
| 5 | Manhasset Bay; off Sinclair Oil Co. dock | Oct. 18, 1957 | 14,100 | Do. |
| 6 | Manhasset Bay; off pier in Kings Point | Mar. 12, 1957 | 13,250 | Do. |
| 7 | Whitney Lake, Manhasset | Oct. 18, 1957 | 10 | |
| 8 | Whitney Lake outlet, Manhasset | do | 10 | |
| 9 | Outlet of unnamed pond, Kings Point | Mar. 12, 1957 | 14 | |
| 10 | Wilsons Pond, Kings Point | do | 12,250 | Near south end. |
| 11 | Scudders Pond, Sea Cliff | do | 960 | |
| 12 | Unnamed pond, Glen Cove | Oct. 24, 1957 | 12 | Near east end. |
| 13 | Unnamed pond, Port Washington | Oct. 18, 1957 | 20 | Near outlet. |
| 14 | Mill Pond, Port Washington | Mar. 30, 1956 | 2,800 | Near east end. |
| | | May 28, 1957 | 1,800 | Do. |
| 15 | do | Mar. 30, 1956 | 4,200 | Near west end. |
| | | May 28, 1957 | 1,900 | Do. |
| 16 | Leeds Pond, Plandome | June 30, 1955 | 1,500 | Near south end. |
| | | Oct. 18, 1957 | 3,000 | Do. |
| 17 | Leeds Pond outlet, Plandome | June 30, 1955 | 6,500 | Outlet culvert. |
| | | Oct. 18, 1957 | 4,300 | Below spillway. |
| 18 | Stannards Brook, Port Washington | Oct. 18, 1957 | 22 | Near well N2635. |
| 19 | Plandome-Port Washington Drain, Port Washington. | Oct. 18, 1957 | 17 | Near well N2269. |





The water of ponds and streams in the project area normally contains less than 30 ppm chloride (See table 10). However, some ponds in shore areas afford ingress to particularly high tides and thus may be brackish at times. Chloride determinations of water from the larger tidal ponds are included in table 10. The location of surface-water sampling points is shown in figure 14.

The water temperature of streams fluctuates seasonally with air temperature, but within narrower extremes. A moderating influence is exercised by the temperature of the ground-water inflow, which generally sustains streamflow. Temperature in upstream reaches of a stream may be modified to a greater extent by prevailing ground-water temperature than that in downstream reaches, where air temperature and atmospheric conditions may become the dominant modifying factors. Thus, water temperatures vary from stream to stream and also along different reaches of the same stream. Monthly water-temperature measurements of some streams in eastern and southern Nassau County are given by R. M. Sawyer (1958). The data show general agreement of water temperature with monthly mean air temperature.

### UTILIZATION OF SURFACE WATER

Fresh surface-water sources are not utilized in northwestern Nassau County for industrial or public supplies. Salt water pumped from Hempstead Harbor and Manhasset Bay is used in several sand and gravel pits for washing and size-sorting operations and in settling ponds. Large quantities of salt water also are used for cooling purposes at a power-generating plant in Glenwood Landing.

## SUMMARY AND CONCLUSIONS

In general, ground-water supplies in sufficient quantity and of excellent quality can be obtained from the three aquifers underlying northwestern Nassau and northeastern Queens Counties. Ground-water withdrawals for public supply have increased with population growth and expanded use from about 10 mgd in 1940 to 30 mgd in 1957. In addition, about 10 mgd are pumped for various industrial, institutional and private uses. Much of the water pumped for industrial purposes is returned to the ground by diffusion wells and recharge basins. However, an increasing amount of water is lost from the ground-water reservoir owing to the expanding network of sewer systems discharging directly to the sea, whereas formerly this water was artificially returned to the ground through individual cesspools or municipal leaching fields.

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**REFERENCE 30**

HQ-30
1 of 10

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MINEOLA, N.Y. 11501-4250

September 28, 1994

Mr. Michael Heffron
Ebasco Services Incorporated
One Oxford Valley
Suite 200
2300 Lincoln Highway East
Langhorne, PA 19047-1829

Dear Mr. Heffron:

Enclosed is the information you requested. The location on the topographic map was taken from our maps, but in transferring the data may be an approximation. I have enclosed a "GROUND WATER AND PUBLIC WATER SUPPLY FACTS, OCTOBER 1993" (GWF) manual. This manual contains a good amount of information. The attached sheets will help you with the location, capacity and depth. The GWF is the most recent information we have for release at this time.

I hope you will find the information beneficial.

Sincerely yours,

Salvatore Caruso

Salvatore Caruso
Public Health Engineer
Bureau of Water Supply Protection

SC:mf
Encs.

#3298J(29)

516-571-3323

SALVATORE CARUSO
PUBLIC HEALTH ENGINEER

NASSAU COUNTY
DEPARTMENT OF HEALTH
BUREAU OF WATER SUPPLY PROTECTION

240 OLD COUNTRY ROAD
MINEOLA, NY 11501

Ref. 30
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# PORT WASHINGTON WATER DISTRICT

38 SANDY HOLLOW ROAD
PORT WASHINGTON, NY 11050
767-0171

FICIAL: BETTY FORQUER, CHAIRMAN
ERINTENDENT: STEVEN NEKELSKI

BORATORY: ECOTEST
NSULTANT: HENDERSON & CASEY

TOWN: NORTH HEMPSTEAD
POPULATION: 33,000

TREATMENT: CHLORINATION (e)
CAUSTIC SODA
GRANULAR ACTIVATED CARBON

## WELLS (13)

| OCAL MBER | NYS N-NUMBER | AQUIFER | ADDRESS | COMMUNITY | CAPACITY (GPM) | DEPTH (FT) | | STATUS | TREATMENT |
|---|---|---|---|---|---|---|---|---|---|
| N1 | N-01715 | L | NEULIST AVE | PT WASHINGTON | 510 | 480 | 430 | YR | 1,3A |
| 2 | N-01716 | L | NEULIST AVE | PT WASHINGTON | 684 | 475 | 425 | YR | 1,3A |
| 3 | N-02030 | M | NEULIST AVE | PT WASHINGTON | 510 | 215 | 190 | YR | 1,3A |
| H4 | N-02052 | M | HEWLETT AVE | FLOWER HILL | 1200 | 325 | 275 | YR | 1,3A,6B |
| 5 | N-04223 | M | WAKEFIELD AVE | PT WASHINGTON N | 700 | 326 | 273 | NU | 1 |
| 6 | N-05209 | M | BAR BEACH RD | PT WASHINGTON | 900 | 300 | 260 | YR | 1,3A |
| R7 | N-05876 | M | CHESTNUT RD | FLOWER HILL | 500 | 238 | 168 | YR | 1,3A |
| H1 | N-04860 | G | SANDY HOLLOW RD | BAXTER EST | 550 | 89 | 60 | YR | 1,3A,6B |
| 2 | N-06087 | G | SANDY HOLLOW RD | BAXTER EST | 500 | 92 | 62 | YR | 1,3A,6B |
| SH3 | N-04859 | L | SANDY HOLLOW RD | BAXTER EST | 350 | 385 | 355 | NU | 1 |
| MP8 | N-07551 | M | MORLEY PARK | NORTH HILLS | 1400 | 469 | | YR | 1,6B |
| 9 | N-07552 | M | MORLEY PARK | NORTH HILLS | 1400 | 454 | | VR [a] | 1,6B |
| 10 | N-09809 | PW | STONEYTOWN RD | FLOWER HILL | 1350 | 524 | 433 | YR | 1,3A |

## STORAGE TANKS (4)

| TYPE | ADDRESS | COMMUNITY | CAPACITY (MG) |
|---|---|---|---|
| ELEVATED | BEACON HILL RD | PT WASHINGTON | 0.25 |
| ELEVATED | WAKEFIELD AVE | FLOWER HILL | 1.0 |
| GROUND | SANDY HOLLOW RD | BAXTER ESTATES | 1.0 |
| GROUND | NEULIST AVE | PT WASHINGTON | 20.0 |

[a] ...UNTARILY REMOVED FROM SERVICE BY SUPPLIER BASED ON A VOC RESULT EXEEDING A MCL

103114

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Ref. 30
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# ROSLYN WATER DISTRICT

24 WEST SHORE ROAD
ROSLYN, NY 11575
MA1-7770

!CIAL: DOUGLAS W. PIERCE, CHAIRMAN
ERINTENDENT: CARMINE CIPRIANO

TOWN: NORTH HEMPSTEAD
POPULATION: 28,000

)RATORY: PEDNEAULT
SULTANT: SIDNEY BOWNE

TREATMENT:CHLORINATION (e)
CHLORINATION
CAUSTIC SODA

## WELLS (8)

| ~CAL IBER | NYS N-NUMBER | AQUIFER | ADDRESS | COMMUNITY | CAPACITY (GPM) | DEPTH (FT) | STATUS | TREATMENT |
|---|---|---|---|---|---|---|---|---|
| 8Z | •N-01870• | M | SHORE RD | ROSLYN | 1499 | 260 | OC | 2 |
| 2 | N-02400 | M | LOCUST RD & LIE | EAST HILLS | 1000 | 439 | VR [a] | 2,3A |
| 3 | N-04265 | M | GLEN COVE RD | EAST HILLS | 1200 | 485 | OC | 2 |
| 4 | N-04623 | M | DIANA TRAIL | ROSLYN EST | 1200 | 498 | YR | 2,3A |
| 5 | •N-05852 • | M | SYCAMORE DR | EAST HILLS | 1200 | 482 432 | YR | 2,3A |
| 6 | •N-07104 • | M | PARTRIDGE DR | EAST HILLS | 1200 | 431 361 | YR | 2,3A |
| 7 | N-07873 | M | TARA DR | EAST HILLS | 1200 | 530 | YR | 2,3A |
| 1 | N-08010 | M | MINEOLA AVE | ROSLYN EST | 1200 | 446 | YR | 2,3A |

## STORAGE TANKS (4)

| TYPE | ADDRESS | COMMUNITY | CAPACITY (MG) |
|---|---|---|---|
| STANDPIPE | DIANA TRAIL | ROSLYN EST | 1.0 |
| GROUND | ELM DR | EAST HILLS | 3.0 |
| STANDPIPE | MIMOSA DR | EAST HILLS | 0.3 |
| STANDPIPE | TARA DR | EAST HILLS | 2.0 |

.UNTARILY REMOVED FROM SERVICE BY SUPPLIER BASED ON A VOC RESULT EXCEEDING A MCL.

103115

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# SEA CLIFF WATER SUPPLY COMPANY

410 LAKEVILLE ROAD
LAKE SUCCESS, NY 11040
OR6-1166

FICIAL: RUSSELL KOPKE, PRESIDENT
JPERINTENDENT: ANTHONY GRELLA SR.

ORATORY: H2M & JAMAICA W.S.CO.
)NSULTANT: CARL BECKER

TOWN: OYSTER BAY
POPULATION: 17,860

TREATMENT: CHLORINATION
POLYPHOSPHATE
CAUSTIC SODA

## WELLS (3)

| CAL MBER | NYS N-NUMBER | AQUIFER | ADDRESS | COMMUNITY | CAPACITY (GPM) | DEPTH (FT) | STATUS | TREATMENT |
|---|---|---|---|---|---|---|---|---|
| H | N-05792 | M | ROSLYN DR | GLEN HEAD | 1050 | 295 255 | YR | 1,3A,4A |
| C | N-07857 | L | RESERVOIR ST | SEA CLIFF | 1300 | 614 560 | YR | 1,3A,4A |
| IESEL | N-00901 | G | PROSPECT AVE | SEA CLIFF | ? | 68 | NU | 1,3A,4A |

## STORAGE TANKS (2)

| TYPE | ADDRESS | COMMUNITY | CAPACITY (MG) |
|---|---|---|---|
| ELEVATED | ROSLYN DR | GLEN HEAD | 0.5 |
| STANDPIPE | RESERVOIR ST | SEA CLIFF | 0.25 |

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# CITY OF GLEN COVE

16 BRIDGE STREET
GLEN COVE, N.Y. 11542
676-2297

OFFICIAL: DONALD DeRIGGI, MAYOR
SUPERINTENDENT: ANGELO MARTINO

LABORATORY: ECOTEST
CONSULTANT: SIDNEY BOWNE

TOWN: OYSTER BAY
POPULATION: 28,000

TREATMENT: CHLORINATION (E
CAUSTIC SODA,
AIR STRIPPING

## WELLS (8)

| LOCAL NUMBER | NYS N-NUMBER | AQUIFER | ADDRESS | COMMUNITY | CAPACITY (GPM) | DEPTH (FT) | screen depth | STATUS | TREATM |
|---|---|---|---|---|---|---|---|---|---|
| M | N-00835 | L | MORGAN ISLAND | GLEN COVE | 550 | 300 | 276 | NU | 2,3/ |
| 21 | N-08326 | M | CARNEY ST | GLEN COVE | 1400 | 165 | 120 | RO [a] | 2,3/ |
| 1S | N-03892 | M | SEAMAN RD | GLEN COVE | 700 | 246 | 138 | RO [b] | 2,3/ |
| 2S | N-05261 | M | SEAMAN RD | GLEN COVE | 1400 | 230 | 129 | VR [c] | 2,3/ |
| R | N-05762 | M | ROXBURY | GLEN COVE | 1400 | 280 | 221 | YR | 2,8/ |
| 30 | N-09210 | M | DUCK POND RD | GLEN COVE | 1400 | 275 | 209 | YR | 2,3/ |
| 31 | N-09211 | M | DUCK POND RD | GLEN COVE | 1400 | 269 | 209 | YR | 2,3/ |
| K | N-09334 | M | KELLY ST | GLEN COVE | 1200 | 298 | 248 | VR [d] | 2,3A,( |

## STORAGE TANKS (3)

| TYPE | ADDRESS | COMMUNITY | CAPACITY (MG) |
|---|---|---|---|
| ELEVATED | LEECH CIRCLE | GLEN COVE | 0.25 |
| ELEVATED | MCLOUGHLIN ST | GLEN COVE | 1.0 |
| GROUND | DUCK POND ROAD | GLEN COVE | 3.0 |

[a] RESTRICTED: 1985 FOR TRICHLOROETHYLENE. WELL NOT USED.
[b] RESTRICTED: 1977 FOR TETRACHLOROETHYLENE. WELL NOT USED.
[c] VOLUNTARILY REMOVED FROM SERVICE BY SUPPLIER BASED ON VOC RESULT EXCEEDING A MCL.
[d] VOLUNTARILY REMOVED FROM SERVICE BY SUPPLIER BASED ON VOC RESULT EXCEEDING A MCL.
TREATED BY AIR STRIPPING. USE WITH TREATMENT ONLY.

103117

# SANDS POINT VILLAGE

P.O. BOX 188
PORT WASHINGTON, NY 11050
883-3491

FICIAL: LEONARD WURZEL, MAYOR
PERINTENDENT: DOMINIC GALLUCCIO

BORATORY: H2M
NSULTANT: SIDNEY BOWNE

TOWN: NORTH HEMPSTEAD
POPULATION: 2795

TREATMENT: CHLORINATION (e)
POLYPHOSPHATE
CAUSTIC SODA

## WELLS (6)

| LOCAL NUMBER | NYS N-NUMBER | AQUIFER | ADDRESS | COMMUNITY | CAPACITY (GPM) | DEPTH (FT) | STATUS | TREATMENT |
|---|---|---|---|---|---|---|---|---|
| 1 | N-00036 | PW | TIBBITTS LA | SANDS POINT | 650 | 214 200 | YR | 2 |
| 2 | N-00037 | G | TIBBITTS LA | SANDS POINT | 650 | 140 120 | YR | 2,3A |
| 5 | N-08313 | G | TIBBITTS LA | SANDS POINT | 650 | 165 114 | YR | 2,3A |
| 3 | N-04389 | M | ASTORS LA/IBM CC | SANDS POINT | 500 | 225 150 | YR | 2,3A |
| 4 | N-07157 | M | ASTORS LA/IBM CC | SANDS POINT | 500 | 240 135 | YR | 2,3A |
| 6 | N-09446 | L | HARRIMAN LA | SANDS POINT | 600 | 368 328 | YR | 2,3A |

## STORAGE TANKS (3)

| TYPE | ADDRESS | COMMUNITY | CAPACITY (MG) |
|---|---|---|---|
| ELEVATED | TIBBITTS LA | SANDS POINT | 0.3 |
| ELEVATED | IBM CC | SANDS POINT | 0.25 |
| ELEVATED | N.C PRESERVE | SANDS POINT | 0.1 |

103118

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# JERICHO WATER DISTRICT


125 CONVENT ROAD
SYOSSET, N.Y. 11791
WA1-8280


ICIAL: NICHOLAS J. BARTILUCCI, CHAIRMAN
JPERINTENDENT: JOSEPH PASSARIELLO

ORATORY: ECOTEST
ONSULTANT: SIDNEY BOWNE

TOWN: OYSTER BAY
POPULATION: 58,000

TREATMENT: CHLORINATION [e]
CAUSTIC SODA.

## WELLS (22)

| CAL NUMBER | NYS N-NUMBER | AQUIFER | ADDRESS | COMMUNITY | CAPACITY (GPM) | DEPTH (FT) | STATUS | TREATMENT |
|---|---|---|---|---|---|---|---|---|
| 3 | N-00198 | M | N/S CONVENT LANE | SYOSSET | 1150 | 617 screen depth (H) | YR | 2,3A |
| 4 | N-00199 | M | N/S CONVENT LANE | SYOSSET | 1120 | 600 | YR | 2,3A |
| 5 | N-00570 | M | N/S CONVENT LANE | SYOSSET | 1200 | 600 | YR | 2,3A |
| 3 | N-03474 | M | N/S WHEATLEY ROAD | BROOKVILLE | 1200 | 512 | YR | 2,3A |
| 7 | N-03475 | M | N/S WHEATLEY ROAD | BROOKVILLE | 1200 | 482 | YR | 2,3A |
| 16 | N-07446 | M | N/S WHEATLEY ROAD | BROOKVILLE | 1200 | 493 | OC | 2,3A |
| 1 | N-05201 | L | W/S MOTTS COVE RD | ROSLYN HARBOR | 1200 | 504 | NU | 2,3A |
| 2 | N-06092 | M | W/S CYPRESS DR | WOODBURY | 1200 | 631 | YR | 2,3A |
| 13 | N-06093 | M | W/S CYPRESS DR | WOODBURY | 1200 | 606 | YR | 2,3A |
| 4 | N-06651 | M | N/S TOBIE LA | JERICHO | 1200 | 610 | YR | 2,3A |
| | N-04245 | M | S/S JERICHO TPK | JERICHO | 1200 | 565 | YR | 2,3A |
| 15 | N-07030 | M | CANTIAQUE ROCK | JERICHO | 1200 | 530 | VR [a] | 2,3A |
| 7 | N-07593 | M | COLD SPRING RD | LAUREL HOLLOW | 1200 | 468 | YR | 2,3A |
| ) | N-07772 | M | W/S SPLIT ROCK RD | SYOSSET | 1200 | 563 | YR | 2,3A |
| 19 | N-07773 | M | W/S SPLIT ROCK RD | SYOSSET | 1200 | 560 | YR | 2,3A |
| 20 | N-10149 | M | S/S STILLWELL LA | SYOSSET | 1380 | 625 | YR | 2,3A |
| ! | N-07781 | M | EAST NORWICH RD | JERICHO | 1200 | 454 | OC | 2,3A |
| 23 | N-08043 | M | SUNNYSIDE BLVD | WOODBURY | 1200 | 688 | YR | 2,3A |
| 25 | N-08355 | M | KIRBY LA | MUTTONTOWN | 1400 | 590 | YR | 2,3A |
| | N-08713 | M | N/S SIMONSON RD | O. BROOKVILLE | 1400 | 372 3/2 | YR | 2,3A |
| [illegible] | N-11107 | M | W/S E NORWICH RD | MUTTONTOWN | 1200 | 585 | YR | 2,3A |
| 30 | N-11295 | M | W/S E NORWICH RD | MUTTONTOWN | 1380 | 535 | YR | 2,3A |

103119

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# JERICHO WATER DISTRICT

## STORAGE TANKS (6)

| TYPE | ADDRESS | COMMUNITY | CAPACITY (MG) |
|---|---|---|---|
| GROUND | KIRBY LANE | MUTTONTOWN | 3.0 |
| ELEVATED | WHEATLEY RD | BROOKVILLE | 1.0 |
| ELEVATED | CONVENT LA | SYOSSET | 1.5 |
| ELEVATED | JERICHO TPKE | JERICHO | 1.5 |
| STAND PIPE | ORCHARD DR | WOODBURY | 2.0 |
| STAND PIPE | SPLIT ROCK RD | SYOSSET | 3.4 |

a] VOLUNTARILY REMOVED FROM SERVICE BY SUPPLIER BASED ON VOC RESULT EXCEEDING A MCL

AN 8/91

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# NORTH SHORE UNIVERSITY HOSPITAL @ GLEN COVE

ST. ANDREWS LANE
GLEN COVE, N.Y. 11542
676-5000

:IAL: MAUREEN DWYER, ADMINISTRATOR
ERINTENDENT: TIM PLANK, DIRECTOR OF ENGINEERING

RATORY: H2M
NSULTANT: H2M

TOWN: OYSTER BAY
POPULATION: 1,400

TREATMENT: CHLORINATION, CAUSTIC SODA

## WELLS (1)

| DCAL ''BER | NYS N-NUMBER | AQUIFER | ADDRESS | COMMUNITY | CAPACITY (GPM) | DEPTH (FT) | STATUS | TREATMENT |
|---|---|---|---|---|---|---|---|---|
| 1 | N-05994 | G | ST. ANDREWS LA | GLEN COVE | 1080 | 226 | 173 Screen (ft) YR | 1,3A |

## STORAGE TANKS (1)

| TYPE | ADDRESS | COMMUNITY | CAPACITY (GAL) |
|---|---|---|---|
| GROUND (2 TANKS) | ST. ANDREWS LA | GLEN COVE | 20,000 |

103121

AN 1/92

Ref. 30
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# LOCUST VALLEY WATER DISTRICT

BUCKRAM ROAD
LOCUST VALLEY, N.Y. 11560
OR1-1783

ICIAL: ALLAN SCHLOTZHAUER, CHAIRMAN
UPERINTENDENT: DAVID McCOY

ORATORY: H2M
NSULTANT: SIDNEY BOWNE AND SON

TOWN: OYSTER BAY
POPULATION: 7500

TREATMENT: CHLORINATION (E)
CAUSTIC SODA

## WELLS (5)

| LOCAL BER | NYS N-NUMBER | AQUIFER | ADDRESS | COMMUNITY | CAPACITY (GPM) | DEPTH (FT) | | STATUS | TREATMENT |
|---|---|---|---|---|---|---|---|---|---|
| 4 | N-00118 | L | S/S BUCKRAM RD | LOCUST VALLEY | 1100 | 471 | 412 | OC | 2 |
| 5 | N-00119 | L | S/S BUCKRAM RD | LOCUST VALLEY | 1600 | 571 | 497 | NU | 2 |
| 6 | N-01651 | L | W/S 10TH ST | LOCUST VALLEY | 800 | 465 | 385 | OC | 2,3A |
| 7 | N-05152 | L | W/S BAYVILLE RD | LATTINGTOWN | 1100 | 355 | 305 | YR | 2,3A |
| 8 | N-07665 | M | DUCK POND RD | MATINECOCK | 1200 | 370 | 320 | YR | 2,3A |

## STORAGE TANKS (1)

| TYPE | ADDRESS | COMMUNITY | CAPACITY (MG) |
|---|---|---|---|
| ELEVATED | DUCK POND RD | MATINECOCK | 1.0 |

103122

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**REFERENCE 31**

# EPA REGION II
# SCANNING TRACKING SHEET

DOC ID # 36762

DOC TITLE/SUBJECT:
**4 MILE RADIUS MAP**

THIS DOCUMENT IS OVERSIZED AND CAN BE LOCATED IN THE ADMINISTRATIVE RECORD FILE AT THE

**SUPERFUND RECORDS CENTER**
290 BROADWAY, 18$^{TH}$ FLOOR
NEW YORK, NY 10007

**REFERENCE 32**

# FROST ASSOCIATES

Ref 52
1 of 15

P.O.Box 495, Essex, Connecticut 06426
(203) 767-7644 FAX (203) 767-1971

Nov 16, 1994

To: Edgar Aguado
201-842-7254

Fr: Bob Frost
Frost Associates
P.O. Box 495
Essex, Conn 06426

Tel: (203) 767-1254
Fax: (203) 767-7069

Sub: Captain's Cove Condominiums
Garvies Pt. Road, Glen Cove, Nassua Cty, NY

CERCLIS: NYD000069377

Id : 40009

Site Longitude: 73-38-48.00 73.646667
Site Latitude : 40-51-24 40.856670

The CENTRACTS report below identifies the population, households, and private water wells of each Block Group that lies within, or partially within, the 4, 3, 2, 1, .5, and .25, mile "rings" of the latitude and longitude coordinates above. CENTRACTS may have up to ten radii of any length. 1000 block groups, and 15000 block group sides.

CENTRACTS uses the 1990 Block Group population and Block Group house count data found in the Census Bureau's 1990 STF-1A files. The sources of water supply data are from the Bureau's 1990 STF-3A files. The boundary line coordinates of the Block Groups were extracted from the Census Bureau's 1990 TIGER/Line Files.

CENTRACTS reports are created with programs written by Frost Associates, P.O. Box 495, Essex, Conn. The code was written using Microsoft's Quick-Basic Ver. 4.5.

Latitude and Longitude coordinates identifying a site are entered in degrees and decimal degrees. One or more county files holding Block Group boundary lines are selected for use by CENTRACTS by determining whether the site coordinates fall within the minimum and maximum Lat\Lon coordinates of each county in the state.

Each Block Group line segment has Lat\Lon coordinates representing the "From" and "To" ends of that line. All coordinates from the selected county files are read and converted from degrees, decimal degrees to X\Y miles from the site location. Each line segment is then examined whether it lies within or partially within the maximum ring from the site.

The unique Block Group ID numbers of each line segment that lie within the maximum ring are retained. All Block Group boundary lines matching the Block Group numbers are then extracted from the respective county files to obtain all sides of the included Block Groups. Boundary records are then sorted in adjacent side order to determine the shape and area of each Block Group polygon.

A method to solve for the area of a polygon is to take one-half the sum of the products obtained by multiplying each X-coordinate by the difference between the adjacent Y-coordinates. For a polygon with coordinates at adjacent angles A, B, C, D, and E. The formula can be expressed:

Captain's Cove Condominiums
Garvies Pt Rd, Glen Cove, Nassau Cty, NY
0009

rea = 1/2{Xa(Ye-Yb)+ Xb(Ya-Yb)+ Xc(Yb-Yd)+ Xd(Yc-Ye)+ Xe(Yd-Ya)}

or each ring, the selected Block Groups will be inside, outside, or intersected by the ring. When a polygon is intersected, the partial Block Group area within that ring is calculated using the method described below.

hen a ring intersects a Block Group, the intersect points are solved and plotted at the points where the ring enters and exits the shape. The chord line, a line within the circle connecting the intersect points is determined. This chord line is used to alculate the segment area, the half moon shape between the chord line and the ring, nd the sub-polygon created by the chord line and the Block Group boundaries that lie outside the ring.

he segment area is subtracted from the sub-polygon area to determine the area of the sub-polygon outside the ring. The area outside the ring is then subtracted from the area of the entire polygon to arrive at the inside area. This inside area is then divided by the tract's total area to determine the percentage of area within the ring. This process is repeated for each block group that is intersected by one of the rings. The total area, partial area, and percentage of partial area of those block groups within, or partially within a ring, are held in memory for the report.

n occasion, the algorithm described above is unable to determine the area of the partial area. Within the report program is a "Paint" routine which allows an enclosed shape to be highlighted. Another routine calculates the percentage of highlighted creen pixels to the pixels within the polygon. A manual entry is allowed. Both the paint" method and manual entry method over ride the calculated method.

CENTRACTS lists, starting on page 4, all Block Groups in State, County, Census Tract, nd Block Group ID order that lie within, or partially within, the maximum ring. Each lock Group is identified by a City or Town name and by the Block Group's State, County, Tract and Block Group ID number. Following is the Block Group's 1990 populu ion and house count extracted from the Census Bureau's 1990 STF-1A files.

The next four columns display water source data from the 1990 STF-3A files. The first column is "Units with Public system or private company source of water", followed by "Units with individual well, Drilled, source of water"; "Units with individual well, Dug, source of water" and "Units with Other source of water".

For each ring, CENTRACTS then shows the Block Groups that are within that ring, the Block Group's total area in square miles, the partial area of the Block Group within that ring, and the partial percentage within the ring. The areas of the included Block Group and the partial areas are then totaled.

The last section tallies the demographic data within each ring. The percentage of area for each Block Group is multiplied times the census data for that Block Group and totaled for all Block Group's within the ring. Ring totals are then determined by subtracting the three mile data from the four mile, the two mile from the three mile, one from the two, etc... Population on private wells is calculated using the formula: ((Drilled + Dug Wells) / Households) * Population



103127

Captain's Cove Condominiums
Garvies Pt Rd, Glen Cove, Nassau Cty, NY
4 )09

Rd 32
3 of 13

| No. | City | Block Group ID | Blk Grp People | House Holds | Public Water | Drilled Wells | Dug Wells | Other |
|---|---|---|---|---|---|---|---|---|
| 1 | North Hempstead | 36059 3010 1 | 1086 | 387 | 399 | 0 | 0 | 0 |
| 2 | North Hempstead | 36059 3010 2 | 1512 | 527 | 537 | 0 | 0 | 0 |
| 3 | North Hempstead | 36059 3010 3 | 529 | 166 | 159 | 0 | 0 | 0 |
| 4 | North Hempstead | 36059 3010 4 | 1449 | 491 | 504 | 0 | 0 | 0 |
| 5 | North Hempstead | 36059 3012 1 | 930 | 380 | 382 | 0 | 0 | 0 |
| 6 | North Hempstead | 36059 3012 2 | 1521 | 622 | 628 | 0 | 0 | 0 |
| 7 | North Hempstead | 36059 3012 3 | 868 | 306 | 297 | 0 | 0 | 0 |
| 8 | North Hempstead | 36059 3012 4 | 367 | 137 | 132 | 0 | 0 | 0 |
| 9 | North Hempstead | 36059 3012 5 | 558 | 186 | 173 | 0 | 0 | 0 |
| 10 | North Hempstead | 36059 3012 6 | 1571 | 669 | 688 | 0 | 0 | 0 |
| 1 | North Hempstead | 36059 3013 1 | 1800 | 591 | 624 | 0 | 0 | 0 |
| 2 | North Hempstead | 36059 3013 2 | 831 | 317 | 322 | 0 | 0 | 0 |
| 13 | North Hempstead | 36059 3013 3 | 628 | 255 | 240 | 0 | 0 | 5 |
| 14 | North Hempstead | 36059 3013 4 | 1208 | 426 | 441 | 0 | 0 | 0 |
| 5 | North Hempstead | 36059 3013 5 | 487 | 213 | 210 | 0 | 0 | 0 |
| 6 | North Hempstead | 36059 3014 1 | 1187 | 444 | 421 | 0 | 0 | 0 |
| 17 | North Hempstead | 36059 3014 2 | 857 | 314 | 297 | 0 | 0 | 0 |
| 8 | North Hempstead | 36059 3015 1 | 846 | 289 | 288 | 0 | 0 | 0 |
| 9 | North Hempstead | 36059 3015 4 | 493 | 166 | 161 | 0 | 0 | 2 |
| 0 | North Hempstead | 36059 3016 1 | 1419 | 457 | 460 | 0 | 0 | 0 |
| 21 | North Hempstead | 36059 3016 2 | 794 | 315 | 304 | 0 | 0 | 0 |
| 2 | North Hempstead | 36059 3016 3 | 1266 | 400 | 413 | 0 | 0 | 0 |
| 3 | North Hempstead | 36059 3016 4 | 1040 | 343 | 325 | 5 | 0 | 7 |
| 4 | North Hempstead | 36059 3017 1 | 1429 | 452 | 448 | 0 | 0 | 0 |
| 25 | North Hempstead | 36059 3020 1 | 1324 | 585 | 594 | 0 | 0 | 0 |
| 6 | North Hempstead | 36059 3020 2 | 1709 | 870 | 872 | 0 | 0 | 0 |
| 7 | Glen Cove | 36059 5170 1 | 548 | 209 | 196 | 0 | 0 | 0 |
| 28 | Glen Cove | 36059 5170 2 | 1851 | 554 | 574 | 0 | 0 | 0 |
| 9 | Glen Cove | 36059 5170 3 | 904 | 342 | 335 | 0 | 0 | 0 |
| 0 | Glen Cove | 36059 5172 1 | 1283 | 524 | 550 | 0 | 0 | 0 |
| 1 | Glen Cove | 36059 5172 2 | 1421 | 543 | 513 | 0 | 0 | 0 |
| 32 | Glen Cove | 36059 5172 3 | 1408 | 612 | 612 | 0 | 0 | 0 |
| 3 | Glen Cove | 36059 5172 4 | 896 | 298 | 298 | 0 | 0 | 0 |
| 4 | Glen Cove | 36059 5172 5 | 1006 | 337 | 341 | 0 | 0 | 0 |
| 5 | Oyster Bay | 36059 5174 1 | 1278 | 492 | 527 | 0 | 0 | 0 |
| 36 | Oyster Bay | 36059 5174 2 | 1261 | 443 | 426 | 0 | 0 | 0 |
| 7 | Oyster Bay | 36059 5174 3 | 669 | 303 | 304 | 0 | 0 | 9 |
| 8 | Oyster Bay | 36059 5174 4 | 737 | 368 | 368 | 0 | 13 | 0 |
| 39 | Oyster Bay | 36059 5174 5 | 1109 | 460 | 419 | 0 | 0 | 0 |
| 40 | Oyster Bay | 36059 5175 1 | 1186 | 438 | 461 | 0 | 0 | 0 |
| 1 | Oyster Bay | 36059 5175 2 | 1198 | 423 | 428 | 0 | 2 | 0 |
| 2 | Oyster Bay | 36059 5175 3 | 1224 | 464 | 427 | 0 | 0 | 0 |
| 43 | Oyster Bay | 36059 5176 1 | 1018 | 348 | 313 | 0 | 0 | 0 |
| 4 | Oyster Bay | 36059 5176 2 | 1591 | 602 | 632 | 0 | 0 | 0 |
| 5 | Oyster Bay | 36059 5176 3 | 685 | 263 | 281 | 0 | 0 | 0 |
| 6 | Oyster Bay | 36059 5176 4 | 1194 | 438 | 425 | 0 | 0 | 0 |
| 47 | North Hempstead | 36059 3011011 | 2149 | 824 | 872 | 0 | 0 | 0 |
| 8 | North Hempstead | 36059 3011012 | 2296 | 915 | 910 | 0 | 0 | 0 |
| 9 | North Hempstead | 36059 3011013 | 1227 | 586 | 543 | 0 | 0 | 0 |
| 50 | North Hempstead | 36059 3011021 | 1175 | 411 | 388 | 0 | 0 | 0 |
| 51 | North Hempstead | 36059 3011022 | 1000 | 525 | 515 | 0 | 0 | 0 |
| 2 | North Hempstead | 36059 3011023 | 1326 | 399 | 400 | 0 | 0 | 0 |
| 3 | North Hempstead | 36059 3011024 | 671 | 216 | 220 | 0 | 0 | 0 |
| 54 | North Hempstead | 36059 3021011 | 722 | 300 | 291 | 0 | 0 | 0 |



103128

Ref. 32
4 of 13

Captain's Cove Condominiums
Garvies Pt Rd, Glen Cove, Nassau Cty, NY
ı009

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 55 | North Hempstead | 36059 3021012 | 1533 | 490 | 479 | 0 | 0 | 0 |
| 56 | North Hempstead | 36059 3021013 | 959 | 324 | 357 | 0 | 0 | 0 |
| 57 | North Hempstead | 36059 3021014 | 968 | 327 | 305 | 0 | 0 | 0 |
| 58 | Glen Cove | 36059 5171012 | 1047 | 417 | 428 | 0 | 0 | 0 |
| 59 | Glen Cove | 36059 5171013 | 699 | 250 | 241 | 0 | 0 | 0 |
| 60 | Glen Cove | 36059 5171014 | 1227 | 432 | 411 | 0 | 0 | 0 |
| 61 | Glen Cove | 36059 5171015 | 790 | 303 | 317 | 0 | 0 | 0 |
| 62 | Glen Cove | 36059 5171016 | 873 | 317 | 322 | 0 | 0 | 0 |
| 63 | Glen Cove | 36059 5171021 | 1354 | 387 | 387 | 0 | 0 | 0 |
| 64 | Glen Cove | 36059 5171022 | 1347 | 402 | 399 | 0 | 3 | 0 |
| 65 | Glen Cove | 36059 5173011 | 939 | 361 | 353 | 0 | 0 | 0 |
| 66 | Glen Cove | 36059 5173012 | 654 | 215 | 203 | 0 | 0 | 0 |
| 67 | Glen Cove | 36059 5173013 | 995 | 406 | 441 | 0 | 0 | 0 |
| 68 | Glen Cove | 36059 5173014 | 220 | 159 | 144 | 0 | 0 | 0 |
| 69 | Glen Cove | 36059 5173024 | 1490 | 545 | 555 | 0 | 0 | 0 |
| 70 | Glen Cove | 36059 5173025 | 1133 | 424 | 398 | 0 | 0 | 0 |
| 71 | Glen Cove | 36059 5173026 | 1024 | 366 | 365 | 0 | 0 | 6 |
| 72 | Glen Cove | 36059 5173027 | 1040 | 395 | 406 | 0 | 0 | 0 |
| 73 | Oyster Bay | 36059 5177011 | 1625 | 584 | 565 | 0 | 5 | 0 |
| 74 | Oyster Bay | 36059 5177012 | 1763 | 580 | 563 | 0 | 5 | 0 |
| 75 | Oyster Bay | 36059 5177013 | 3155 | 987 | 1004 | 0 | 0 | 0 |
| 76 | Oyster Bay | 36059 5177041 | 1959 | 23 | 34 | 0 | 0 | 0 |
| 77 | Oyster Bay | 36059 5177051 | 1708 | 578 | 577 | 0 | 6 | 0 |
| 78 | Oyster Bay | 36059 5177052 | 566 | 173 | 179 | 0 | 0 | 0 |
| 79 | Oyster Bay | 36059 5178011 | 1397 | 516 | 505 | 2 | 0 | 2 |
| 80 | Oyster Bay | 36059 5178012 | 1047 | 410 | 342 | 3 | 53 | 0 |
| 81 | Oyster Bay | 36059 5178013 | 1264 | 484 | 455 | 0 | 48 | 0 |
| 82 | Oyster Bay | 36059 5178021 | 1276 | 472 | 475 | 0 | 0 | 0 |
| 83 | Oyster Bay | 36059 5178022 | 1009 | 442 | 436 | 0 | 14 | 5 |
| 84 | Oyster Bay | 36059 5178023 | 1205 | 434 | 439 | 0 | 9 | 7 |
| === | ================ | ============ | ====== | ====== | ====== | ====== | ====== | |
| | Totals: | | 97008 | 35148 | 34973 | 10 | 158 | 43 |



103129

Captain's Cove Condominiums
Garvies Pt Rd, Glen Cove, Nassau Cty, NY
4 )09

Def. 32
5 of 13

| City | Census Tract ID | Tract People | House Count | Public Water | Drilled Wells | Dug Wells | Other Wells |
|---|---|---|---|---|---|---|---|
| Glen Cove | 36059 5171022 | 1347 | 402 | 399 | 0 | 3 | 0 |
| Glen Cove | 36059 5173011 | 939 | 361 | 353 | 0 | 0 | 0 |
| Glen Cove | 36059 5173012 | 654 | 215 | 203 | 0 | 0 | 0 |
| Glen Cove | 36059 5173013 | 995 | 406 | 441 | 0 | 0 | 0 |
| Glen Cove | 36059 5173014 | 220 | 159 | 144 | 0 | 0 | 0 |
| Glen Cove | 36059 5170 1 | 548 | 209 | 196 | 0 | 0 | 0 |
| Glen Cove | 36059 5170 2 | 1851 | 554 | 574 | 0 | 0 | 0 |
| Glen Cove | 36059 5170 3 | 904 | 342 | 335 | 0 | 0 | 0 |
| Glen Cove | 36059 5172 1 | 1283 | 524 | 550 | 0 | 0 | 0 |
| Glen Cove | 36059 5172 2 | 1421 | 543 | 513 | 0 | 0 | 0 |
| Glen Cove | 36059 5172 3 | 1408 | 612 | 612 | 0 | 0 | 0 |
| Glen Cove | 36059 5172 4 | 896 | 298 | 298 | 0 | 0 | 0 |
| Glen Cove | 36059 5172 5 | 1006 | 337 | 341 | 0 | 0 | 0 |
| Glen Cove | 36059 5171015 | 790 | 303 | 317 | 0 | 0 | 0 |
| Glen Cove | 36059 5171016 | 873 | 317 | 322 | 0 | 0 | 0 |
| Glen Cove | 36059 5171012 | 1047 | 417 | 428 | 0 | 0 | 0 |
| Glen Cove | 36059 5171013 | 699 | 250 | 241 | 0 | 0 | 0 |
| Glen Cove | 36059 5171014 | 1227 | 432 | 411 | 0 | 0 | 0 |
| Glen Cove | 36059 5173026 | 1024 | 366 | 365 | 0 | 0 | 6 |
| Glen Cove | 36059 5173027 | 1040 | 395 | 406 | 0 | 0 | 0 |
| Glen Cove | 36059 5171021 | 1354 | 387 | 387 | 0 | 0 | 0 |
| Glen Cove | 36059 5173024 | 1490 | 545 | 555 | 0 | 0 | 0 |
| Glen Cove | 36059 5173025 | 1133 | 424 | 398 | 0 | 0 | 0 |
| | Sub Totals: | 24149 | 8798 | 8789 | 0 | 3 | 6 |
| North Hempstead | 36059 3013 4 | 1208 | 426 | 441 | 0 | 0 | 0 |
| North Hempstead | 36059 3013 5 | 487 | 213 | 210 | 0 | 0 | 0 |
| North Hempstead | 36059 3012 1 | 930 | 380 | 382 | 0 | 0 | 0 |
| North Hempstead | 36059 3010 1 | 1086 | 387 | 399 | 0 | 0 | 0 |
| North Hempstead | 36059 3010 2 | 1512 | 527 | 537 | 0 | 0 | 0 |
| North Hempstead | 36059 3010 3 | 529 | 166 | 159 | 0 | 0 | 0 |
| North Hempstead | 36059 3010 4 | 1449 | 491 | 504 | 0 | 0 | 0 |
| North Hempstead | 36059 3012 6 | 1571 | 669 | 688 | 0 | 0 | 0 |
| North Hempstead | 36059 3013 1 | 1800 | 591 | 624 | 0 | 0 | 0 |
| North Hempstead | 36059 3013 2 | 831 | 317 | 322 | 0 | 0 | 0 |
| North Hempstead | 36059 3013 3 | 628 | 255 | 240 | 0 | 0 | 5 |
| North Hempstead | 36059 3021013 | 959 | 324 | 357 | 0 | 0 | 0 |
| North Hempstead | 36059 3021014 | 968 | 327 | 305 | 0 | 0 | 0 |
| North Hempstead | 36059 3014 1 | 1187 | 444 | 421 | 0 | 0 | 0 |
| North Hempstead | 36059 3014 2 | 857 | 314 | 297 | 0 | 0 | 0 |
| North Hempstead | 36059 3015 1 | 846 | 289 | 288 | 0 | 0 | 0 |
| North Hempstead | 36059 3015 4 | 493 | 166 | 161 | 0 | 0 | 2 |
| North Hempstead | 36059 3016 1 | 1419 | 457 | 460 | 0 | 0 | 0 |
| North Hempstead | 36059 3016 2 | 794 | 315 | 304 | 0 | 0 | 0 |
| North Hempstead | 36059 3016 3 | 1266 | 400 | 413 | 0 | 0 | 0 |
| North Hempstead | 36059 3016 4 | 1040 | 343 | 325 | 5 | 0 | 7 |
| North Hempstead | 36059 3017 1 | 1429 | 452 | 448 | 0 | 0 | 0 |
| North Hempstead | 36059 3020 1 | 1324 | 585 | 594 | 0 | 0 | 0 |
| North Hempstead | 36059 3011011 | 2149 | 824 | 872 | 0 | 0 | 0 |
| North Hempstead | 36059 3012 2 | 1521 | 622 | 628 | 0 | 0 | 0 |
| North Hempstead | 36059 3012 3 | 868 | 306 | 297 | 0 | 0 | 0 |
| North Hempstead | 36059 3012 4 | 367 | 137 | 132 | 0 | 0 | 0 |
| North Hempstead | 36059 3012 5 | 558 | 186 | 173 | 0 | 0 | 0 |
| North Hempstead | 36059 3011023 | 1326 | 399 | 400 | 0 | 0 | 0 |

Captain's Cove Condominiums
Garvies Pt Rd, Glen Cove, Nassau Cty, NY
‘ 009

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| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| North Hempstead | 36059 | 3011024 | 671 | 216 | 220 | 0 | 0 | 0 |
| North Hempstead | 36059 | 3021011 | 722 | 300 | 291 | 0 | 0 | 0 |
| North Hempstead | 36059 | 3021012 | 1533 | 490 | 479 | 0 | 0 | 0 |
| North Hempstead | 36059 | 3011021 | 1175 | 411 | 388 | 0 | 0 | 0 |
| North Hempstead | 36059 | 3011022 | 1000 | 525 | 515 | 0 | 0 | 0 |
| North Hempstead | 36059 | 3020 2 | 1709 | 870 | 872 | 0 | 0 | 0 |
| North Hempstead | 36059 | 3011012 | 2296 | 915 | 910 | 0 | 0 | 0 |
| North Hempstead | 36059 | 3011013 | 1227 | 586 | 543 | 0 | 0 | 0 |
| | Sub Totals: | | 41735 | 15625 | 15599 | 5 | 0 | 14 |
| Oyster Bay | 36059 | 5174 1 | 1278 | 492 | 527 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5174 2 | 1261 | 443 | 426 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5175 3 | 1224 | 464 | 427 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5176 1 | 1018 | 348 | 313 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5176 2 | 1591 | 602 | 632 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5176 3 | 685 | 263 | 281 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5176 4 | 1194 | 438 | 425 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5174 3 | 669 | 303 | 304 | 0 | 0 | 9 |
| Oyster Bay | 36059 | 5174 4 | 737 | 368 | 368 | 0 | 13 | 0 |
| Oyster Bay | 36059 | 5174 5 | 1109 | 460 | 419 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5175 1 | 1186 | 438 | 461 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5175 2 | 1198 | 423 | 428 | 0 | 2 | 0 |
| Oyster Bay | 36059 | 5177011 | 1625 | 584 | 565 | 0 | 5 | 0 |
| Oyster Bay | 36059 | 5177012 | 1763 | 580 | 563 | 0 | 5 | 0 |
| Oyster Bay | 36059 | 5177013 | 3155 | 987 | 1004 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5177041 | 1959 | 23 | 34 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5177051 | 1708 | 578 | 577 | 0 | 6 | 0 |
| Oyster Bay | 36059 | 5177052 | 566 | 173 | 179 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5178011 | 1397 | 516 | 505 | 2 | 0 | 2 |
| Oyster Bay | 36059 | 5178012 | 1047 | 410 | 342 | 3 | 53 | 0 |
| Oyster Bay | 36059 | 5178013 | 1264 | 484 | 455 | 0 | 48 | 0 |
| Oyster Bay | 36059 | 5178021 | 1276 | 472 | 475 | 0 | 0 | 0 |
| Oyster Bay | 36059 | 5178022 | 1009 | 442 | 436 | 0 | 14 | 5 |
| Oyster Bay | 36059 | 5178023 | 1205 | 434 | 439 | 0 | 9 | 7 |
| | Sub Totals: | | 31124 | 10725 | 10585 | 5 | 155 | 23 |

Captain's Cove Condominiums
Garvies Pt Rd, Glen Cove, Nassau Cty, NY
1009

Ref 32
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For Radius of 4 Mi., Circle Area = 50.265482

| No. | City | Block Group ID | Total Area | Partial Area | % Within Radius |
|---|---|---|---|---|---|
| 1 | North Hempstead | 36059 30101 | 1.255878 | 1.255878 | 100.00 |
| 2 | North Hempstead | 36059 30102 | 1.161290 | 0.749033 | 64.50 |
| 3 | North Hempstead | 36059 30103 | 1.806815 | 1.806815 | 100.00 |
| 4 | North Hempstead | 36059 30104 | 1.806835 | 1.032437 | 57.14 |
| 5 | North Hempstead | 36059 30121 | 0.169091 | 0.169091 | 100.00 |
| 6 | North Hempstead | 36059 30122 | 0.169357 | 0.169357 | 100.00 |
| 7 | North Hempstead | 36059 30123 | 0.106238 | 0.106238 | 100.00 |
| 8 | North Hempstead | 36059 30124 | 0.069332 | 0.069332 | 100.00 |
| 9 | North Hempstead | 36059 30125 | 0.118803 | 0.118803 | 100.00 |
| 10 | North Hempstead | 36059 30126 | 1.160672 | 0.798814 | 68.82 |
| 11 | North Hempstead | 36059 30131 | 0.212240 | 0.212240 | 100.00 |
| 12 | North Hempstead | 36059 30132 | 0.095181 | 0.095181 | 100.00 |
| 13 | North Hempstead | 36059 30133 | 0.085484 | 0.085484 | 100.00 |
| 14 | North Hempstead | 36059 30134 | 0.219232 | 0.219232 | 100.00 |
| 15 | North Hempstead | 36059 30135 | 0.044090 | 0.044090 | 100.00 |
| 16 | North Hempstead | 36059 30141 | 0.122411 | 0.122411 | 100.00 |
| 17 | North Hempstead | 36059 30142 | 0.900360 | 0.900360 | 100.00 |
| 18 | North Hempstead | 36059 30151 | 0.520982 | 0.346351 | 66.48 |
| 19 | North Hempstead | 36059 30154 | 0.422283 | 0.022605 | 5.35 |
| 20 | North Hempstead | 36059 30161 | 0.608093 | 0.608093 | 100.00 |
| 21 | North Hempstead | 36059 30162 | 0.147116 | 0.092177 | 62.66 |
| 22 | North Hempstead | 36059 30163 | 0.518055 | 0.445511 | 86.00 |
| 23 | North Hempstead | 36059 30164 | 0.357413 | 0.195014 | 54.56 |
| 24 | North Hempstead | 36059 30171 | 0.309696 | 0.025413 | 8.21 |
| 25 | North Hempstead | 36059 30201 | 1.770507 | 1.708014 | 96.47 |
| 26 | North Hempstead | 36059 30202 | 0.371102 | 0.107024 | 28.84 |
| 27 | Glen Cove | 36059 51701 | 1.667853 | 1.667853 | 100.00 |
| 28 | Glen Cove | 36059 51702 | 0.861231 | 0.861231 | 100.00 |
| 29 | Glen Cove | 36059 51703 | 0.494123 | 0.494123 | 100.00 |
| 30 | Glen Cove | 36059 51721 | 0.203473 | 0.203473 | 100.00 |
| 31 | Glen Cove | 36059 51722 | 0.318097 | 0.318097 | 100.00 |
| 32 | Glen Cove | 36059 51723 | 0.231981 | 0.231981 | 100.00 |
| 33 | Glen Cove | 36059 51724 | 0.107769 | 0.107769 | 100.00 |
| 34 | Glen Cove | 36059 51725 | 0.175910 | 0.175910 | 100.00 |
| 35 | Oyster Bay | 36059 51741 | 0.198420 | 0.198420 | 100.00 |
| 36 | Oyster Bay | 36059 51742 | 0.392847 | 0.392847 | 100.00 |
| 37 | Oyster Bay | 36059 51743 | 0.078525 | 0.078525 | 100.00 |
| 38 | Oyster Bay | 36059 51744 | 0.099358 | 0.099358 | 100.00 |
| 39 | Oyster Bay | 36059 51745 | 1.080745 | 1.080745 | 100.00 |
| 40 | Oyster Bay | 36059 51751 | 0.573792 | 0.573792 | 100.00 |
| 41 | Oyster Bay | 36059 51752 | 0.404424 | 0.404424 | 100.00 |
| 42 | Oyster Bay | 36059 51753 | 0.241062 | 0.241062 | 100.00 |
| 43 | Oyster Bay | 36059 51761 | 0.189776 | 0.189776 | 100.00 |
| 44 | Oyster Bay | 36059 51762 | 0.934152 | 0.934152 | 100.00 |
| 45 | Oyster Bay | 36059 51763 | 0.122142 | 0.122142 | 100.00 |
| 46 | Oyster Bay | 36059 51764 | 0.317291 | 0.317291 | 100.00 |
| 47 | North Hempstead | 36059 3011011 | 0.124013 | 0.121371 | 97.87 |
| 48 | North Hempstead | 36059 3011012 | 0.130445 | 0.116466 | 89.28 |
| 49 | North Hempstead | 36059 3011013 | 0.268862 | 0.259072 | 96.36 |
| 50 | North Hempstead | 36059 3011021 | 0.147500 | 0.147500 | 100.00 |
| 51 | North Hempstead | 36059 3011022 | 0.304516 | 0.304516 | 100.00 |
| 52 | North Hempstead | 36059 3011023 | 0.121056 | 0.121056 | 100.00 |



103132

Captain's Cove Condominiums
Garvies Pt Rd, Glen Cove, Nassau Cty, NY
4 )09

Ref. 32
8 of 13

| | | | | | |
|---|---|---|---|---|---|
| 53 | North Hempstead | 36059 3011024 | 0.125372 | 0.125372 | 100.00 |
| 54 | North Hempstead | 36059 3021011 | 0.178571 | 0.178571 | 100.00 |
| 55 | North Hempstead | 36059 3021012 | 0.417578 | 0.353409 | 84.63 |
| 56 | North Hempstead | 36059 3021013 | 0.304855 | 0.256152 | 84.02 |
| 57 | North Hempstead | 36059 3021014 | 0.492767 | 0.214381 | 43.51 |
| 58 | Glen Cove | 36059 5171012 | 0.121328 | 0.121328 | 100.00 |
| 59 | Glen Cove | 36059 5171013 | 0.218633 | 0.218633 | 100.00 |
| 60 | Oyster Bay | 36059 5178023 | 0.117574 | 0.117574 | 100.00 |
| 61 | Glen Cove | 36059 5171015 | 0.063724 | 0.063724 | 100.00 |
| 62 | Glen Cove | 36059 5171016 | 0.097953 | 0.097953 | 100.00 |
| 63 | Glen Cove | 36059 5171021 | 0.294210 | 0.294210 | 100.00 |
| 64 | Glen Cove | 36059 5171022 | 0.302504 | 0.302504 | 100.00 |
| 65 | Glen Cove | 36059 5173011 | 0.173936 | 0.173936 | 100.00 |
| 66 | Glen Cove | 36059 5173012 | 0.330795 | 0.330795 | 100.00 |
| 67 | Glen Cove | 36059 5173013 | 0.392756 | 0.392756 | 100.00 |
| 68 | Glen Cove | 36059 5173014 | 0.032285 | 0.032285 | 100.00 |
| 69 | Glen Cove | 36059 5173024 | 0.603468 | 0.603468 | 100.00 |
| 70 | Glen Cove | 36059 5173025 | 0.136867 | 0.136867 | 100.00 |
| 71 | Glen Cove | 36059 5173026 | 0.076148 | 0.076148 | 100.00 |
| 72 | Glen Cove | 36059 5173027 | 0.087723 | 0.087723 | 100.00 |
| 73 | Oyster Bay | 36059 5177011 | 5.183296 | 2.052984 | 39.61 |
| 74 | Oyster Bay | 36059 5177012 | 2.934826 | 2.825240 | 96.27 |
| 75 | Oyster Bay | 36059 5177013 | 6.096198 | 0.068167 | 1.12 |
| 76 | Oyster Bay | 36059 5177041 | 0.533354 | 0.314214 | 58.91 |
| 77 | Oyster Bay | 36059 5177051 | 3.340157 | 0.110862 | 3.32 |
| 78 | Oyster Bay | 36059 5177052 | 2.222283 | 0.603282 | 27.15 |
| 79 | Oyster Bay | 36059 5178011 | 3.543439 | 2.762474 | 77.96 |
| 80 | Oyster Bay | 36059 5178012 | 2.135243 | 0.198913 | 9.32 |
| 81 | Oyster Bay | 36059 5178013 | 4.054915 | 2.355000 | 58.08 |
| 82 | Oyster Bay | 36059 5178021 | 0.521086 | 0.309013 | 59.30 |
| 83 | Oyster Bay | 36059 5178022 | 0.273607 | 0.273607 | 100.00 |
| 84 | Glen Cove | 36059 5171014 | 0.752541 | 0.752541 | 100.00 |
| == | ================= | =========== | ========= | ========= | ====== |
| | Totals: | | 60.477909 | 38.072033 | |

For Radius of 3 Mi., Circle Area = 28.274334

| No. | City | Block Group ID | Total Area | Partial Area | % Within Radius |
|---|---|---|---|---|---|
| 1 | North Hempstead | 36059 30101 | 1.255878 | 1.250172 | 99.55 |
| 2 | North Hempstead | 36059 30102 | 1.161290 | 0.525136 | 45.22 |
| 3 | North Hempstead | 36059 30103 | 1.806815 | 1.409483 | 78.01 |
| 5 | North Hempstead | 36059 30121 | 0.169091 | 0.114367 | 67.64 |
| 6 | North Hempstead | 36059 30122 | 0.169357 | 0.008777 | 5.18 |
| 7 | North Hempstead | 36059 30123 | 0.106238 | 0.000202 | 0.19 |
| 11 | North Hempstead | 36059 30131 | 0.212240 | 0.212240 | 100.00 |
| 12 | North Hempstead | 36059 30132 | 0.095181 | 0.095181 | 100.00 |
| 13 | North Hempstead | 36059 30133 | 0.085484 | 0.085484 | 100.00 |
| 14 | North Hempstead | 36059 30134 | 0.219232 | 0.067809 | 30.93 |
| 15 | North Hempstead | 36059 30135 | 0.044090 | 0.040514 | 91.89 |
| 16 | North Hempstead | 36059 30141 | 0.122411 | 0.122411 | 100.00 |
| 17 | North Hempstead | 36059 30142 | 0.900360 | 0.504816 | 56.07 |
| 25 | North Hempstead | 36059 30201 | 1.770507 | 0.895688 | 50.59 |
| 27 | Glen Cove | 36059 51701 | 1.667853 | 1.606250 | 96.31 |
| 28 | Glen Cove | 36059 51702 | 0.861231 | 0.861231 | 100.00 |
| 29 | Glen Cove | 36059 51703 | 0.494123 | 0.494123 | 100.00 |
| 30 | Glen Cove | 36059 51721 | 0.203473 | 0.203473 | 100.00 |



103133

Captain's Cove Condominiums
Garvies Pt Rd, Glen Cove, Nassau Cty, NY
· 009

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| | | | | | |
|---|---|---|---|---|---|
| 31 | Glen Cove | 36059 51722 | 0.318097 | 0.318097 | 100.00 |
| 32 | Glen Cove | 36059 51723 | 0.231981 | 0.231981 | 100.00 |
| 33 | Glen Cove | 36059 51724 | 0.107769 | 0.107769 | 100.00 |
| 34 | Glen Cove | 36059 51725 | 0.175910 | 0.175910 | 100.00 |
| 35 | Oyster Bay | 36059 51741 | 0.198420 | 0.198420 | 100.00 |
| 36 | Oyster Bay | 36059 51742 | 0.392847 | 0.392847 | 100.00 |
| 37 | Oyster Bay | 36059 51743 | 0.078525 | 0.078525 | 100.00 |
| 38 | Oyster Bay | 36059 51744 | 0.099358 | 0.099358 | 100.00 |
| 39 | Oyster Bay | 36059 51745 | 1.080745 | 1.080745 | 100.00 |
| 40 | Oyster Bay | 36059 51751 | 0.573792 | 0.573792 | 100.00 |
| 41 | Oyster Bay | 36059 51752 | 0.404424 | 0.404025 | 99.90 |
| 42 | Oyster Bay | 36059 51753 | 0.241062 | 0.241062 | 100.00 |
| 43 | Oyster Bay | 36059 51761 | 0.189776 | 0.189776 | 100.00 |
| 44 | Oyster Bay | 36059 51762 | 0.934152 | 0.934152 | 100.00 |
| 45 | Oyster Bay | 36059 51763 | 0.122142 | 0.122142 | 100.00 |
| 46 | Oyster Bay | 36059 51764 | 0.317291 | 0.317291 | 100.00 |
| 50 | North Hempstead | 36059 3011021 | 0.147500 | 0.147500 | 100.00 |
| 51 | North Hempstead | 36059 3011022 | 0.304516 | 0.163025 | 53.54 |
| 52 | North Hempstead | 36059 3011023 | 0.121056 | 0.069220 | 57.18 |
| 54 | North Hempstead | 36059 3021011 | 0.178571 | 0.004232 | 2.37 |
| 58 | Glen Cove | 36059 5171012 | 0.121328 | 0.121328 | 100.00 |
| 59 | Glen Cove | 36059 5171013 | 0.218633 | 0.218633 | 100.00 |
| 60 | Oyster Bay | 36059 5178023 | 0.117574 | 0.117574 | 100.00 |
| 61 | Glen Cove | 36059 5171015 | 0.063724 | 0.063724 | 100.00 |
| 62 | Glen Cove | 36059 5171016 | 0.097953 | 0.097953 | 100.00 |
| 63 | Glen Cove | 36059 5171021 | 0.294210 | 0.294210 | 100.00 |
| 64 | Glen Cove | 36059 5171022 | 0.302504 | 0.302504 | 100.00 |
| 65 | Glen Cove | 36059 5173011 | 0.173936 | 0.173936 | 100.00 |
| 66 | Glen Cove | 36059 5173012 | 0.330795 | 0.330795 | 100.00 |
| 67 | Glen Cove | 36059 5173013 | 0.392756 | 0.392756 | 100.00 |
| 68 | Glen Cove | 36059 5173014 | 0.032285 | 0.032285 | 100.00 |
| 69 | Glen Cove | 36059 5173024 | 0.603468 | 0.603468 | 100.00 |
| 70 | Glen Cove | 36059 5173025 | 0.136867 | 0.136867 | 100.00 |
| 71 | Glen Cove | 36059 5173026 | 0.076148 | 0.076148 | 100.00 |
| 72 | Glen Cove | 36059 5173027 | 0.087723 | 0.087723 | 100.00 |
| 73 | Oyster Bay | 36059 5177011 | 5.183296 | 1.226171 | 23.66 |
| 74 | Oyster Bay | 36059 5177012 | 2.934826 | 1.240209 | 42.26 |
| 79 | Oyster Bay | 36059 5178011 | 3.543439 | 0.841733 | 23.75 |
| 81 | Oyster Bay | 36059 5178013 | 4.054915 | 0.422052 | 10.41 |
| 82 | Oyster Bay | 36059 5178021 | 0.521086 | 0.000646 | 0.12 |
| 83 | Oyster Bay | 36059 5178022 | 0.273607 | 0.219570 | 80.25 |
| 84 | Glen Cove | 36059 5171014 | 0.752541 | 0.752541 | 100.00 |
| == | ================= | ============ | ========== | ========== | ====== |
| | Totals: | | 37.876404 | 22.100054 | |

I r Radius of 2 Mi., Circle Area = 12.566371

| o. | City | Block Group ID | Total Area | Partial Area | % Within Radius |
|---|---|---|---|---|---|
| 1 | North Hempstead | 36059 30101 | 1.255878 | 0.251536 | 20.03 |
| 2 | North Hempstead | 36059 30102 | 1.161290 | 0.188245 | 16.21 |
| 3 | North Hempstead | 36059 30103 | 1.806815 | 0.424912 | 23.52 |
| 17 | North Hempstead | 36059 30142 | 0.900360 | 0.000009 | 0.00 |
| 25 | North Hempstead | 36059 30201 | 1.770507 | 0.024409 | 1.38 |
| 27 | Glen Cove | 36059 51701 | 1.667853 | 1.035670 | 62.10 |
| 28 | Glen Cove | 36059 51702 | 0.861231 | 0.583077 | 67.70 |
| 29 | Glen Cove | 36059 51703 | 0.494123 | 0.494123 | 100.00 |

Ref. 32
10 of 13

| | | | | | |
|---|---|---|---|---|---|
| 30 | Glen Cove | 36059 51721 | 0.203473 | 0.203473 | 100.00 |
| 31 | Glen Cove | 36059 51722 | 0.318097 | 0.318097 | 100.00 |
| 2 | Glen Cove | 36059 51723 | 0.231981 | 0.231981 | 100.00 |
| 33 | Glen Cove | 36059 51724 | 0.107769 | 0.107769 | 100.00 |
| 34 | Glen Cove | 36059 51725 | 0.175910 | 0.175910 | 100.00 |
| 5 | Oyster Bay | 36059 51741 | 0.198420 | 0.198420 | 100.00 |
| 6 | Oyster Bay | 36059 51742 | 0.392847 | 0.392847 | 100.00 |
| 37 | Oyster Bay | 36059 51743 | 0.078525 | 0.078525 | 100.00 |
| 38 | Oyster Bay | 36059 51744 | 0.099358 | 0.099358 | 100.00 |
| 9 | Oyster Bay | 36059 51745 | 1.080745 | 1.080745 | 100.00 |
| 0 | Oyster Bay | 36059 51751 | 0.573792 | 0.535055 | 93.25 |
| 42 | Oyster Bay | 36059 51753 | 0.241062 | 0.127992 | 53.10 |
| 43 | Oyster Bay | 36059 51761 | 0.189776 | 0.031234 | 16.46 |
| 4 | Oyster Bay | 36059 51762 | 0.934152 | 0.682000 | 73.01 |
| 45 | Oyster Bay | 36059 51763 | 0.122142 | 0.064998 | 53.21 |
| 46 | Oyster Bay | 36059 51764 | 0.317291 | 0.317291 | 100.00 |
| 58 | Glen Cove | 36059 5171012 | 0.121328 | 0.121328 | 100.00 |
| 9 | Glen Cove | 36059 5171013 | 0.218633 | 0.218633 | 100.00 |
| 61 | Glen Cove | 36059 5171015 | 0.063724 | 0.063724 | 100.00 |
| 62 | Glen Cove | 36059 5171016 | 0.097953 | 0.097953 | 100.00 |
| 3 | Glen Cove | 36059 5171021 | 0.294210 | 0.107199 | 36.44 |
| 4 | Glen Cove | 36059 5171022 | 0.302504 | 0.284743 | 94.13 |
| 65 | Glen Cove | 36059 5173011 | 0.173936 | 0.159767 | 91.85 |
| 66 | Glen Cove | 36059 5173012 | 0.330795 | 0.255144 | 77.13 |
| 7 | Glen Cove | 36059 5173013 | 0.392756 | 0.215314 | 54.82 |
| 68 | Glen Cove | 36059 5173014 | 0.032285 | 0.032285 | 100.00 |
| 69 | Glen Cove | 36059 5173024 | 0.603468 | 0.192109 | 31.83 |
| 70 | Glen Cove | 36059 5173025 | 0.136867 | 0.038301 | 27.98 |
| 1 | Glen Cove | 36059 5173026 | 0.076148 | 0.076148 | 100.00 |
| 72 | Glen Cove | 36059 5173027 | 0.087723 | 0.087723 | 100.00 |
| 73 | Oyster Bay | 36059 5177011 | 5.183296 | 0.105962 | 2.04 |
| 4 | Glen Cove | 36059 5171014 | 0.752541 | 0.752541 | 100.00 |
| = | ================= | =========== | ========= | ========= | ====== |
| | Totals: | | 24.051565 | 10.456550 | |

For Radius of 1 Mi., Circle Area = 3.141593

| No. | City | Block Group ID | Total Area | Partial Area | % Within Radius |
|---|---|---|---|---|---|
| 7 | Glen Cove | 36059 51701 | 1.667853 | 0.146204 | 8.77 |
| 9 | Glen Cove | 36059 51703 | 0.494123 | 0.147073 | 29.76 |
| 30 | Glen Cove | 36059 51721 | 0.203473 | 0.146985 | 72.24 |
| 31 | Glen Cove | 36059 51722 | 0.318097 | 0.085615 | 26.91 |
| 2 | Glen Cove | 36059 51723 | 0.231981 | 0.147678 | 63.66 |
| 33 | Glen Cove | 36059 51724 | 0.107769 | 0.107769 | 100.00 |
| 34 | Glen Cove | 36059 51725 | 0.175910 | 0.175910 | 100.00 |
| 35 | Oyster Bay | 36059 51741 | 0.198420 | 0.181321 | 91.38 |
| 36 | Oyster Bay | 36059 51742 | 0.392847 | 0.088892 | 22.63 |
| 37 | Oyster Bay | 36059 51743 | 0.078525 | 0.078525 | 100.00 |
| 38 | Oyster Bay | 36059 51744 | 0.099358 | 0.099358 | 100.00 |
| 39 | Oyster Bay | 36059 51745 | 1.080745 | 0.623577 | 57.70 |
| 6 | Oyster Bay | 36059 51764 | 0.317291 | 0.007390 | 2.33 |
| 58 | Glen Cove | 36059 5171012 | 0.121328 | 0.021027 | 17.33 |
| 59 | Glen Cove | 36059 5171013 | 0.218633 | 0.218633 | 100.00 |
| 61 | Glen Cove | 36059 5171015 | 0.063724 | 0.063724 | 100.00 |
| 62 | Glen Cove | 36059 5171016 | 0.097953 | 0.090875 | 92.77 |
| 67 | Glen Cove | 36059 5173013 | 0.392756 | 0.008450 | 2.15 |

Captain's Cove Condominiums
G-rvies Pt Rd, Glen Cove, Nassau Cty, NY
' 009

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| | | | | | |
|---|---|---|---|---|---|
| 84 | Glen Cove | 36059 5171014 | 0.752541 | 0.702585 | 93.36 |
| == | ================== | ============ | ========== | ========== | ====== |
| | Totals: | | 7.013328 | 3.141593 | |

I r Radius of .5 Mi., Circle Area = 0.785398

| o. | City | Block Group ID | Total Area | Partial Area | % Within Radius |
|---|---|---|---|---|---|
| 34 | Glen Cove | 36059 51725 | 0.175910 | 0.129233 | 73.47 |
| 35 | Oyster Bay | 36059 51741 | 0.198420 | 0.020015 | 10.09 |
| 37 | Oyster Bay | 36059 51743 | 0.078525 | 0.022569 | 28.74 |
| 38 | Oyster Bay | 36059 51744 | 0.099358 | 0.060204 | 60.59 |
| 39 | Oyster Bay | 36059 51745 | 1.080745 | 0.069770 | 6.46 |
| 59 | Glen Cove | 36059 5171013 | 0.218633 | 0.080590 | 36.86 |
| 61 | Glen Cove | 36059 5171015 | 0.063724 | 0.000313 | 0.49 |
| 84 | Glen Cove | 36059 5171014 | 0.752541 | 0.402704 | 53.51 |
| === | ================== | ============ | ========== | ========== | ====== |
| | Totals: | | 2.667856 | 0.785398 | |

I r Radius of .25 Mi., Circle Area = 0.196350

| o. | City | Block Group ID | Total Area | Partial Area | % Within Radius |
|---|---|---|---|---|---|
| 34 | Glen Cove | 36059 51725 | 0.175910 | 0.018502 | 10.52 |
| 39 | Oyster Bay | 36059 51745 | 1.080745 | 0.000000 | 0.00 |
| 59 | Glen Cove | 36059 5171013 | 0.218633 | 0.084530 | 38.66 |
| 84 | Glen Cove | 36059 5171014 | 0.752541 | 0.093317 | 12.40 |
| === | ================== | ============ | ========== | ========== | ====== |
| | Totals: | | 2.227829 | 0.196350 | |



103136

Captain's Cove Condominiums
Garvies Pt Rd, Glen Cove, Nassau Cty, NY
4 309

AF.32
12 of 13

================= Site Data =================

| | |
|---|---|
| Population: | 80475.06 |
| Households: | 29529.88 |
| Drilled Wells: | 4.57 |
| Dug Wells: | 80.81 |
| Other Water Sources: | 37.49 |

= =========== Partial (RING) data ===============

---- Within Ring: 4 Mile(s) and 3 Mile(s) ----

| | |
|---|---|
| Population: | 27798.25 |
| Households: | 9975.83 |
| Drilled Wells: | 4.09 |
| Dug Wells: | 34.28 |
| Other Wells: | 6.00 |

* Population On Private Wells: 106.93

---- Within Ring: 3 Mile(s) and 2 Mile(s) ----

| | |
|---|---|
| Population: | 22444.37 |
| Households: | 8205.14 |
| Drilled Wells: | 0.48 |
| Dug Wells: | 30.60 |
| Other Wells: | 16.49 |

* Population On Private Wells: 85.00

---- Within Ring: 2 Mile(s) and 1 Mile(s) ----

| | |
|---|---|
| Population: | 18633.53 |
| Households: | 6851.65 |
| Drilled Wells: | 0.00 |
| Dug Wells: | 2.93 |
| Other Wells: | 6.00 |

* Population On Private Wells: 7.96

---- Within Ring: 1 Mile(s) and .5 Mile(s) ----

| | |
|---|---|
| Population: | 9102.36 |
| Households: | 3535.47 |
| Drilled Wells: | 0.00 |
| Dug Wells: | 5.12 |
| Other Wells: | 6.41 |

* Population On Private Wells: 13.19

Captain's Cove Condominiums
Garvies Pt Rd, Glen Cove, Nassau Cty, NY
4 009

Ref.
13 of 13

--- Within Ring: .5 Mile(s) and .25 Mile(s) ----

| | |
|---|---|
| Population: | 1968.34 |
| Households: | 776.12 |
| Drilled Wells: | 0.00 |
| Dug Wells: | 7.88 |
| Other Wells: | 2.59 |

* Population On Private Wells: 19.98

--- Within Ring: .25 Mile(s) and 0 Mile(s) ----

| | |
|---|---|
| Population: | 528.21 |
| Households: | 185.67 |
| Drilled Wells: | 0.00 |
| Dug Wells: | 0.00 |
| Other Wells: | 0.00 |

* Population On Private Wells: 0.00

**REFERENCE 33**

**EPA REGION II**
**SCANNING TRACKING SHEET**

DOC ID # 36762

DOC TITLE/SUBJECT:

**4 MILE RADIUS MAP AND 15 MILE WETLANDS MAP**
**WETLANDS LEGEND**

THIS DOCUMENT IS OVERSIZED AND CAN BE LOCATED IN THE ADMINISTRATIVE RECORD FILE AT THE

**SUPERFUND RECORDS CENTER**
290 BROADWAY, 18TH FLOOR
NEW YORK, NY 10007

**EPA REGION II**
**SCANNING TRACKING SHEET**

DOC ID # 36762

DOC TITLE/SUBJECT:
**NATIONAL WETLANDS INVENTORY – FLUSHING, NEW YORK WETLANDS LEGEND**

THIS DOCUMENT IS OVERSIZED AND CAN BE LOCATED IN THE ADMINISTRATIVE RECORD FILE AT THE

**SUPERFUND RECORDS CENTER**
290 BROADWAY, $18^{TH}$ FLOOR
NEW YORK, NY 10007

**EPA REGION II**
**SCANNING TRACKING SHEET**

DOC ID # 36762

DOC TITLE/SUBJECT:

**NATIONAL WETLANDS INVENTORY – LLOYD HARBOR, NY, CONN WETLANDS LEGEND**

THIS DOCUMENT IS OVERSIZED AND CAN BE LOCATED IN THE ADMINISTRATIVE RECORD FILE AT THE

**SUPERFUND RECORDS CENTER**
290 BROADWAY, 18TH FLOOR
NEW YORK, NY 10007

REFERENCE 34

Reference 34 1/5

NATIONAL FLOOD INSURANCE PROGRAM

# FIRM
## FLOOD INSURANCE RATE MAP

TOWN OF
# NORTH HEMPSTEAD, NEW YORK
NASSAU COUNTY

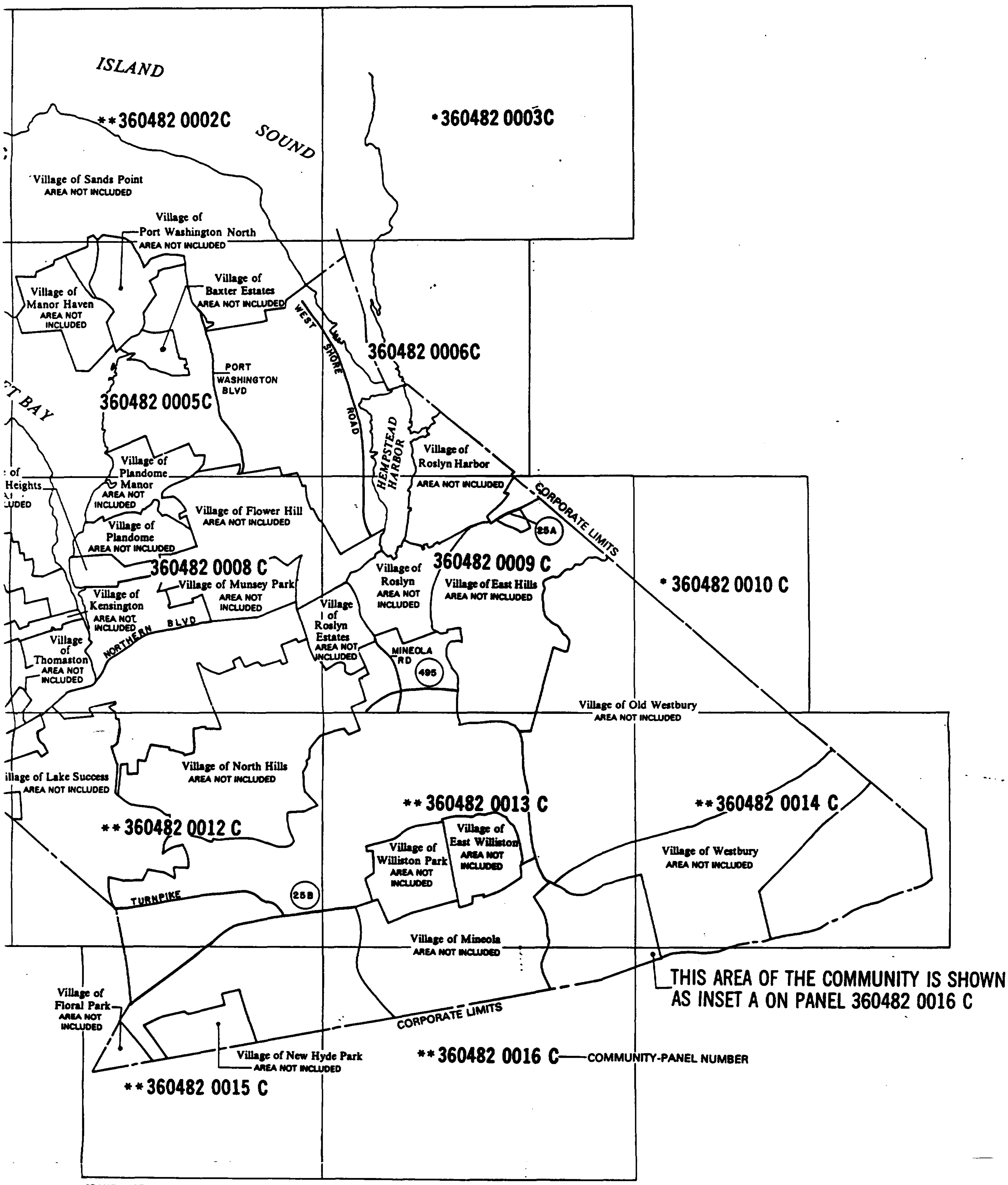
# MAP INDEX
PANELS PRINTED: 5, 6, 7, 8, 9.

COMMUNITY-PANEL NUMBERS
360482 0001-0016

MAP REVISED:
MAY 16, 1983

Federal Emergency Management Agency

103144




*PANEL NOT PRINTED: AREA NOT INCLUDED
**PANEL NOT PRINTED: AREA IN ZONE C
***PANEL NOT PRINTED; OPEN WATER AREA

103145

Reference 3: 3/5

Reference 34. 3/5

NATIONAL FLOOD INSURANCE PROGRAM

# FIRM
## FLOOD INSURANCE RATE MAP

TOWN OF
# NORTH HEMPSTEAD, NEW YORK
NASSAU COUNTY

PANEL 6 OF 16
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
360482 0006 C

MAP REVISED:
MAY 16, 1983

Federal Emergency Management Agency

## KEY TO MAP

| | |
|---|---|
| 500-Year Flood Boundary | ZONE B |
| 100-Year Flood Boundary | |
| Zone Designations* | |
| 100-Year Flood Boundary | ZONE B |
| 500-Year Flood Boundary | |
| Base Flood Elevation Line With Elevation In Feet** | 513 |
| Base Flood Elevation in Feet Where Uniform Within Zone** | (EL 987) |
| Elevation Reference Mark | RM7× |
| Zone D Boundary | |
| River Mile | •M1.5 |

**Referenced to the National Geodetic Vertical Datum of 1929

## *EXPLANATION OF ZONE DESIGNATIONS

| ZONE | EXPLANATION |
|---|---|
| A | Areas of 100-year flood; base flood elevations and flood hazard factors not determined. |
| A0 | Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined. |
| AH | Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined. |
| A1-A30 | Areas of 100-year flood; base flood elevations and flood hazard factors determined. |
| A99 | Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined. |
| B | Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading) |
| C | Areas of minimal flooding. (No shading) |
| D | Areas of undetermined, but possible, flood hazards. |
| V | Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined. |
| V1-V30 | Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined. |

### NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for flood insurance purposes only; it does not necessarily show all areas subject to flooding in the community or all planimetric features outside special flood hazard areas.

For adjoining map panels, see separately printed Index To Map Panels.

**Coastal base flood elevations shown on this map include the effects of wave action.**

INITIAL IDENTIFICATION:
**JUNE 28, 1974**

FLOOD HAZARD BOUNDARY MAP REVISIONS:
**MAY 28, 1976**

FLOOD INSURANCE RATE MAP EFFECTIVE:
**APRIL 15, 1977**

FLOOD INSURANCE RATE MAP REVISIONS:
**MAY 16, 1983: to add new Special Flood Hazard Areas, to reduce Special Flood Hazard Area, to change Zone Designations, to change Base Flood Elevations, to change Zone Boundary Line Designations, to add Street Names, to add Streets.**

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.

N

APPROXIMATE SCALE

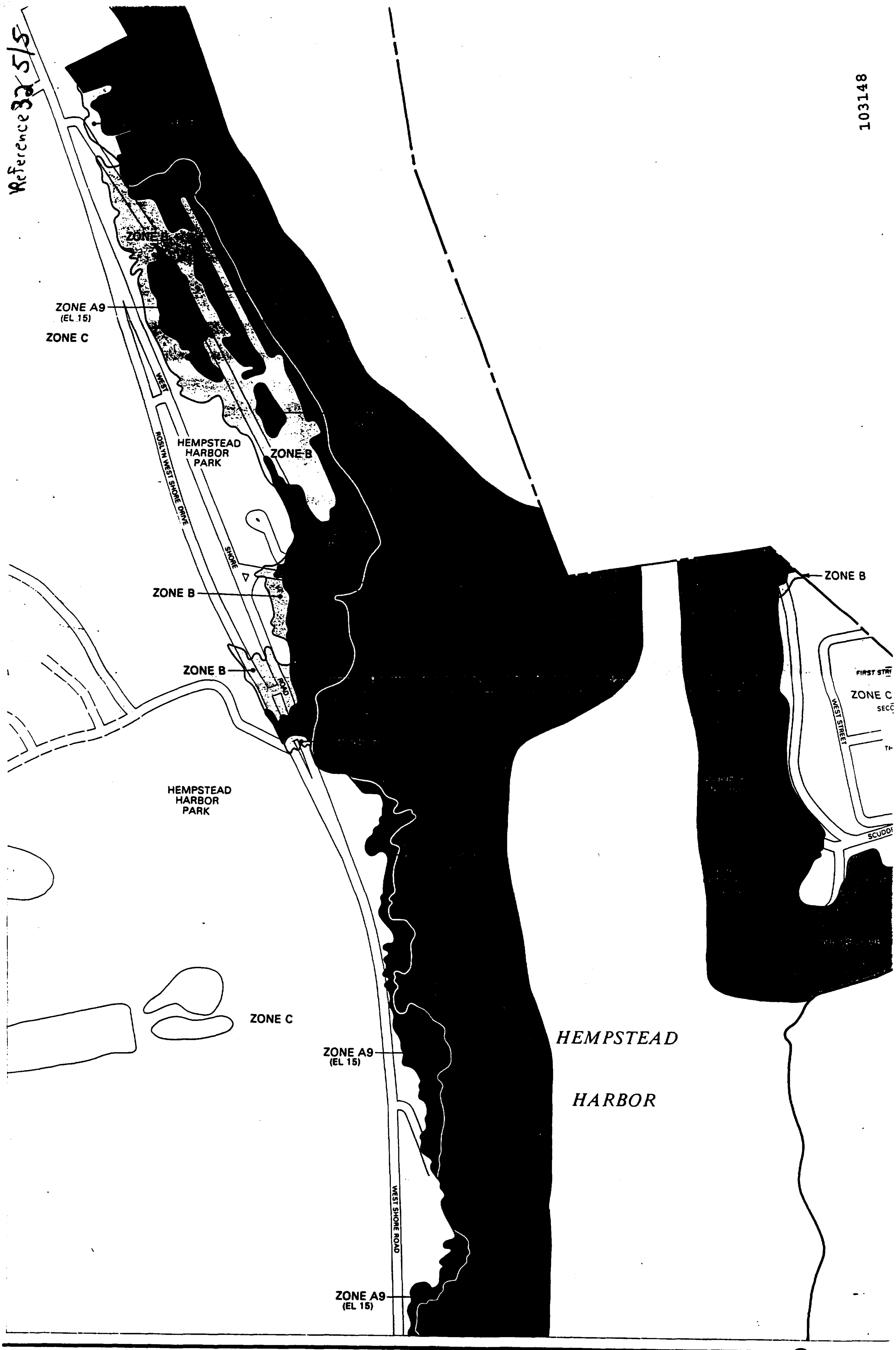
500 0 500 FEET

103147

Reference 35 4/5

Reference 32 5/5

103148



**REFERENCE 35**

RcF. 35
1c F2

D'AMATO, FORCHELLI, SCHWARTZ & MINEO
COUNSELORS AT LAW
370 OLD COUNTRY ROAD
P.O. BOX 31
MINEOLA, NEW YORK 11501-0031
(516) 248-1700

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PETER R. MINEO

THOMAS J. DUNCAN
LAWRENCE R. MILES
STEPHEN GUARNERI

JAMES W. PARÉS
ANTHONY A. CAPETOLA
OF COUNSEL

May 10, 1983

The City of Glen Cove Planning Board
City Hall
Glen Cove, New York 11542

RE: Environmental Impact Statement for
Captain's Cove Condominium Development
Garvies Point, Glen Cove

Dear Members of the Board:

I have been requested to write this letter in response to Items "12" and "13" set forth in the letter of the Nassau County Department of Health dated September 7, 1982.

Item "12" sets forth the Nassau County Department of Health jurisdiction IF THE CONDOMINIUM BE CONSIDERED A REALTY SUBDIVISION UNDER THE PUBLIC HEALTH LAW. It is my opinion that the proposed condominium is not a realty subdivision under the Public Health Law because the property is not being subdivided into five or more parcels for sale as residential lots or building plots.

The Nassau County Department of Health Manual entitled "Sewage Disposal and Other Environmental Factors" apparently agrees with my interpretation. Annexed hereto is a copy of "SECTION 2 - JURISDICTION". The underlined portion confirms that condominiums are realty subdivision$ if (1) there are five or more lots or (2) if an amount of real property is individually owned by the homeowner along with his unit. This is not the case in the Garvies Point project and, accordingly, there is no jurisdiction.

Ref. 35
2 of 2

2. Wetlands

As mentioned earleir through various meetings with N.Y.S.D.E.C., the project has been modified to eliminate N.Y.S.D.E.C. objections and all parties are now "in general agreement" to the revised plans.

3. Flood Plains

The National Flood Insurance Program has revised their Flood Insurance Rate Map effective April 4, 1983. the revision now places the project site in a A-7 zone and requires a lowest floor building elevation of 14'-0" above the 1929 National Geodetic Vertical Datum. The lowest floor building elevation for this project is 14'-0" or higher and conforms to the Federal Emergency Management Agency requirements

4. Sewer Capacity

As mentioned under Section III c., the developers will incorporate the recommendations of the City and their consultants, Sidney Bowne and Sons.

5. Traffic

See Traffic Study by Norman Gerber Associates.

REFERENCE 36

AR.F. 36
1 of 1

11046/2-91

# RECORD OF TELEPHONE CONVERSATION

DATE 9/21/94
14:40

TO Captains Cove Condominium Site
NAME/FILE NO.

FROM Michael Heffron

CLIENT/PROJECT EPA ARCS II

SUBJECT Stream flow of Glen Cove Creek

CHARGE: DEPT. NO. ______ CLIENT SYMBOL ______ OFS NO. ______

DISCUSSION WITH Tony Spinello US Geological Survey (516) 938-8930
Manhasset, NY

The U.S.G.S maintains a ~~*~~ gauging station on Glen Cove Creek at Glen Cove.

The average flow at the gauging station is 7.35 $ft^3/sec$.

He believes that the tidal influence does not reach the pond in which their gage is located. It may be up to the drop off from the pond.

He checked and there is no tidal influence at the gauging station on Glen Cove Creek.

BY [signature] 9/21/94
NAME TITLE DEPT. NO.

CC:

REFERENCE 37

11046/2-91

AF. 37

1 of 3

# RECORD OF TELEPHONE CONVERSATION

DATE 11/4/94

10:45

TO Captain's Cove Condominium Site
NAME/FILE NO.

FROM Michael Heffron

CLIENT/PROJECT EPA ARCS II

SUBJECT Classification of Glen Cove Creek.

CHARGE: DEPT. NO. ____ CLIENT SYMBOL ____ OFS NO. ____

DISCUSSION WITH Bruce Cronemeyer - Fish & Wildlife Technician
New York State Department of (516) 444-0280
Environmental Conservation (Fisheries)
Wildlife Resource Center - Information Services
New York Natural Heritage Program
700 Troy - Schenectady Road
Latham, NY 12110-2400

Glen Cove Creek, near the mouth into Hempstead Harbor, is classified as: I: Standard saline surface water used for primary and secondary contact. Used for fishing and fish propagation.

He will also send me a copy of the info.

BY [signature] 11/4/94
NAME TITLE DEPT. NO.

CC:

103155

from: Water Quality Regulations surface water & groundwater classification & standards NYS codes rules regs title 6 chapter X Parts 700-705

Pg. 37

2 of 3



.t... solids, settleable solids, oil, sludge depos- colored or other wastes or heated liquids at- r other wastes.

is sal of sewage, industrial wastes or other

phorus and nitrogen in amounts that will result it ill impair the waters for their best usages.

ri l Note

new filed: April 28, 1972; Feb. 25, 1974; renum. ew filed Aug. 2, 1991 eff. 30 days after filing.

ir :e waters. (a) The best usages of Class for drinking, culinary or food processing pur- recreation; and fishing. The waters shall be

use international boundary waters that, if coagulation, sedimentation, filtration and necessary, to reduce naturally present impur- tment of Health drinking water standards ctory for drinking water purposes.

ical Note

72; Feb. 25, 1974; amd. filed Sept. 20, 1974; es 1, new filed Aug. 2, 1991 eff. 30 days after

. (a) The best usages of Class AA waters g, ulinary or food processing purposes; pri- a fishing. The waters shall be suitable for

those waters that, if subjected to approved at ent if necessary to remove naturally pres- k ate Department of Health drinking water sare and satisfactory for drinking water pur-

k Note

f d Feb. 25, 1974; amd. filed Sept. 20, 1974; a... new filed Aug. 2, 1991 eff. 30 days after

( The best usages of Class A waters are: y or food processing purposes; primary shing. The waters shall be suitable for fish

se waters that, if subjected to approved ation, filtration and disinfection, with addi- turally present impurities, meet or will meet ing water standards and are or will be vater purposes.

ical Note

; repealed, new filed Aug. r filing.



**701.7 Class B fresh surface waters.** The best usages of Class B waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

**Historical Note**

Sec. filed July 3, 1965; repealed, new filed Aug. 2, 1991 eff. 30 days after filing.

**701.8 Class C fresh surface waters.** The best usage of Class C waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

**Historical Note**

Sec. filed July 3, 1965; repealed, new filed Aug. 2, 1991 eff. 30 days after filing.

**701.9 Class D fresh surface waters.** The best usage of Class D waters is fishing. Due to such natural conditions as intermittency of flow, water conditions not conducive to propagation of game fishery, or stream bed conditions, the waters will not support fish propagation. These waters shall be suitable for fish survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

**Historical Note**

Sec. filed July 3, 1965; repealed, new filed Aug. 2, 1991 eff. 30 days after filing.

## SALINE SURFACE WATERS

**701.10 Class SA saline surface waters.** The best usages of Class SA waters are shellfishing for market purposes, primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

**Historical Note**

Sec. filed July 3, 1965; repealed, new filed Aug. 2, 1991 eff. 30 days after filing.

**701.11 Class SB saline surface waters.** The best usages of Class SB waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

**Historical Note**

Sec. filed July 3, 1965; repealed, new filed Aug. 2, 1991 eff. 30 days after filing.

**701.12 Class SC saline surface waters.** The best usage of Class SC waters is fishing. These waters shall be suitable for fish propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

**Historical Note**

Sec. filed July 3, 1965; repealed, new filed Aug. 2, 1991 eff. 30 days after filing.

**701.13 Class I saline surface waters.** The best usages of Class I waters are secondary contact recreation and fishing. These waters shall be suitable for fish propagation and survival.

**Historical Note**

Sec. filed July 3, 1965; repealed, new filed Aug. 2, 1991 eff. 30 days after filing.

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OFFICIAL COMPILATION
codes rules & Regulations
of the State of NY
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TABLE I (*cont'd*)

| *Item No.* | *Waters Index Number* | *Name* | *Description* | *Map Ref. No.* | *Class* | *Standards* |
|---|---|---|---|---|---|---|
| 33 | HH-33 | Trib. of Hempstead Harbor | | R-25sw | I | I |
| 34 | HH-33-P 129, P130 | Subtribs. of Hempstead Harbor | | R-25sw | C | C |
| 35 | HH-P 135 | Old Westbury Pond | | R-25se | C | C |
| 36 | HH-P 138, P140, P 141 | Tribs. of Hempstead Harbor | | R-25sw | C | C |
| 37 | HH-P 139 | Trib. of Hempstead Harbor | | R-25sw | C | C |
| 37.1 | [*Repealed*] | | | | | |
| 38 | HH-P 141a | Scudders Pond | | R-25sw | C | C |
| 39 | HH-38 portion | Glen Cove Creek | From mouth to inlet of P 143. | R-25sw | I | I |
| 40 | HH-38 portion | Glen Cove Creek | From inlet of P 143 to source. | R-25sw R-25se | C | C |
| 41 | HH-38-P 142 | Trib. of Glen Cove Creek | Marina off Glen Cove Creek. | R-25sw | I | I |
| 42 | HH-38-P 143 | Trib. of Glen Cove Creek | Pond in Pratt Park. | R-25sw | I | I |
| 43 | LIS-40 including P 145a | West Pond | | R-25nw | I | I |
| 44 | LIS-41 including P 146 | Dosoris Pond | | R-25ne R-25nw | SA | SA |
| 45 | LIS-41-1 | Island Swamp Brook | | R-25ne | C | C(T) |





R.F.37
3.F3

REFERENCE 38

Re. 38
1 of 10

**NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION**
Wildlife Resources Center
700 Troy-Schenectady Road
Latham, NY 12110-2400

(518) 783-3932

Langdon Marsh
Acting Commissioner

October 7, 1994

Anne C. Roche
Ebasco
One Oxford Valley, Suite 200
2300 Lincoln Highway East
Langhorne, PA 19047-1829

Dear Ms. Roche:

We have reviewed the New York Heritage Program files with respect to your recent request for biological information concerning Captain's Cove Condominium in Glen Cove, New York State, site as indicated on your enclosed map, 4 mile radius of site and 15 miles downstream of site, located in New York State.

Enclosed is a computer printout covering the area you requested to be reviewed by our staff. The information contained in this report is considered sensitive and may not be released to the public without permission from the New York Natural Heritage Program.

Our files are continually growing as new habitats and occurrences of rare species and communities are discovered. In most cases, site-specific or comprehensive surveys for plant and animal occurrences have not been conducted. For these reasons, we can only provide data which have been assembled from our files. We cannot provide a definitive statement on the presence or absence of species, habitats or natural communities. This information should not be substituted for on-site surveys that may be required for environmental assessment.

This response applies only to known occurrences of rare animals, plants and natural communities and/or significant wildlife habitats. You should contact our regional office, Division of Regulatory Affairs, at the address enclosed for information regarding any regulated areas or permits that may be required (e.g., regulated wetlands) under State Law.

If this proposed project is still active one year from now we recommend that you contact us again so that we can update this response.

Sincerely,
Information Services
New York Natural Heritage Program

Encs.
cc: Reg. 1, Wildlife Mgr.
Reg. 1, Fisheries Mgr.

103159

BIOLOGICAL AND CONSERVATION DATA SYSTEM - ELEMENT OCCURRENCE REPORT, 06 OCT 1994

Prepared by N.Y.S.D.E.C NATURAL HERITAGE PROGRAM

103160

(This report contains sensitive information which should be treated in a sensitive manner. Refer to the Users Guide for explanation of codes and ranks.)

| COUNTY AND TOWN NAME | USGS 7 1/2' TOPOGRAPHIC MAP | LAT. | LONG. | PREC-ISION | SIZE (acres) | SCIENTIFIC NAME | COMMON NAME | ELEMENT TYPE | LAST SEEN | EO RANK | NYS STATUS | FED. STATUS | GLOBAL RANK | STATE RANK | OFFICE | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| * BRONX | | | | | | | | | | | | | | | | |
| CITY OF NEW YORK | FLUSHING | 405224 | 0734701 | S | 5 | MARINE ROCKY INTERTIDAL | MARINE ROCKY INTERTIDAL | COMMUNITY | 1990 | BC | U | | G5 | S1S2 | 4007377 | 24 |
| CITY OF NEW YORK | FLUSHING | 405216 | 0734703 | S | 0 | AMPHIPOEA EREPTA RYENSIS | A NOCTUID MOTH | INVERTEBRATE | 1989 | E | U | | GUT1Q | S1 | 4007377 | 12 |
| CITY OF NEW YORK | FLUSHING | 405150 | 0734740 | S | 0 | TYTO ALBA | COMMON BARN-OWL | VERTEBRATE | 1987 | E | P SC | | G5 | S3 | 4007377 | 13 |
| CITY OF NEW YORK | FLUSHING | 405204 | 0734919 | S | 0 | TYTO ALBA | COMMON BARN-OWL | VERTEBRATE | 1987 | E | P SC | | G5 | S3 | 4007377 | 14 |
| CITY OF NEW YORK | FLUSHING | 405030 | 0734702 | M | 0 | DIGITARIA FILIFORMIS | SLENDER CRABGRASS | PLANT | 1918 | H | R | | G5 | S1S2 | 4007377 | 5 |
| CITY OF NEW YORK | FLUSHING | 405137 | 0734827 | S | 1 | DIOSPYROS VIRGINIANA | PERSIMMON | PLANT | 1986 | D | R | | G5 | S2 | 4007377 | 22 |
| CITY OF NEW YORK | MOUNT VERNON | 405238 | 0734730 | S | 1 | ASCLEPIAS PURPURASCENS | PURPLE MILKWEED | PLANT | 1987 | BC | T | | G4G5 | S3 | 4007387 | 8 |
| * NASSAU | | | | | | | | | | | | | | | | |
| CITY OF GLEN COVE<br>OYSTER BAY | BAYVILLE<br>MAMARONECK<br>HICKSVILLE<br>SEA CLIFF | 405307 | 0733708 | M | 0 | CAREX STYLOFLEXA | BENT SEDGE | PLANT | 1928 | H | U | | G4G5 | S1 | 4007385 | 3 |
| CITY OF GLEN COVE | MAMARONECK<br>BAYVILLE<br>SEA CLIFF | 405304 | 0733817 | M | 0 | ASCLEPIAS RUBRA | RED MILKWEED | PLANT | | H | U | | G4G5 | SX | 4007386 | 10 |

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103161

BIOLOGICAL AND CONSERVATION DATA SYSTEM - ELEMENT OCCURRENCE REPORT, 06 OCT 1994
Prepared by N.Y.S.D.E.C NATURAL HERITAGE PROGRAM

(This report contains sensitive information which should be treated in a sensitive manner. Refer to the Users Guide for explanation of codes and ranks.)

| COUNTY AND TOWN NAME | USGS 7 1/2' TOPOGRAPHIC MAP | LAT. | LONG. | PREC-ISION | SIZE (acres) | SCIENTIFIC NAME | COMMON NAME | ELEMENT TYPE | LAST SEEN | EO RANK | NYS STATUS | FED. STATUS | GLOBAL RANK | STATE RANK | OFFICE | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CITY OF GLEN COVE | SEA CLIFF HICKSVILLE MAMARONECK BAYVILLE | 405142 | 0733743 | M | 0 | ARISTOLOCHIA SERPENTARIA | VIRGINIA SNAKEROOT | PLANT | 1879 | H | U | | G5 | SH | 4007376 | 1 |
| CITY OF GLEN COVE | SEA CLIFF HICKSVILLE MAMARONECK BAYVILLE | 405217 | 0733758 | M | 0 | ASCLEPIAS VARIEGATA | WHITE MILKWEED | PLANT | | H | T | | G5 | S1 | 4007376 | 3 |
| HEMPSTEAD | SEA CLIFF | 404959 | 0734341 | S | 0 | STERNA ANTILLARUM | LEAST TERN | VERTEBRATE | 1988 | D | E | | G4 | S3 | 4007376 | 13 |
| NORTH HEMPSTEAD | SEA CLIFF | 404802 | 0733913 | M | 0 | AGASTACHE NEPETOIDES | YELLOW GIANT-HYSSOP | PLANT | 1928 | H | U | | G5 | S2S3 | 4007376 | 10 |
| NORTH HEMPSTEAD | SEA CLIFF | 404931 | 0734148 | M | 0 | AGASTACHE NEPETOIDES | YELLOW GIANT-HYSSOP | PLANT | 1902 | H | U | | G5 | S2S3 | 4007376 | 11 |
| NORTH HEMPSTEAD | SEA CLIFF | 404929 | 0734200 | M | 0 | LACTUCA FLORIDANA | FALSE LETTUCE | PLANT | 1924 | H | U | | G5 | SH | 4007376 | 6 |
| NORTH HEMPSTEAD | SEA CLIFF | 404948 | 0734151 | M | 0 | LESPEDEZA STUEVEI | VELVETY LESPEDEZA | PLANT | 1915 | H | R | | G4? | S2S3 | 4007376 | 4 |
| NORTH HEMPSTEAD | SEA CLIFF | 404927 | 0734218 | M | 0 | POLYGONUM GLAUCUM | SEABEACH KNOTWEED | PLANT | 1885 | X | U | | G3 | S3 | 4007376 | 12 |
| NORTH HEMPSTEAD | SEA CLIFF | 405125 | 0734332 | M | 0 | SOLIDAGO ERECTA | SLENDER GOLDENROD | PLANT | | H | U | | G5 | SH | 4007376 | 14 |
| OYSTER BAY | BAYVILLE | 405323 | 0733403 | S | 0 | PANDION HALIAETUS | OSPREY | VERTEBRATE | 1988 | E | T | | G5 | S4 | 4007385 | 10 |

103162

BIOLOGICAL AND CONSERVATION DATA SYSTEM - ELEMENT OCCURRENCE REPORT, 06 OCT 1994
Prepared by N.Y.S.D.E.C NATURAL HERITAGE PROGRAM

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| COUNTY AND TOWN NAME | USGS 7 1/2' TOPOGRAPHIC MAP | LAT. | LONG. | PREC-ISION | SIZE (acres) | SCIENTIFIC NAME | COMMON NAME | ELEMENT TYPE | LAST SEEN | EO RANK | NYS STATUS | FED. STATUS | GLOBAL RANK | STATE RANK | OFFICE | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| OYSTER BAY | BAYVILLE | 405318 | 0733302 | M | 0 | AGASTACHE NEPETOIDES | YELLOW GIANT-HYSSOP | PLANT | 1919 | H | U | | G5 | S2S3 | 4007385 | 9 |
| OYSTER BAY | BAYVILLE | 405311 | 0733307 | M | 0 | ASCLEPIAS VARIEGATA | WHITE MILKWEED | PLANT | 1928 | H | T | | G5 | S1 | 4007385 | 1 |
| OYSTER BAY | BAYVILLE HICKSVILLE | 405234 | 0733357 | M | 0 | CAREX STYLOFLEXA | BENT SEDGE | PLANT | 1930 | H | U | | G4G5 | S1 | 4007385 | 12 |
| OYSTER BAY | BAYVILLE | 405244 | 0733354 | S | 1 | EUONYMUS AMERICANA | AMERICAN STRAWBERRY-BUSH | PLANT | 1992 | D | T | | G5 | S1 | 4007385 | 11 |
| OYSTER BAY | BAYVILLE | 405306 | 0733313 | M | 0 | LACTUCA HIRSUTA | DOWNY LETTUCE | PLANT | | F | U | | G4? | S1S2 | 4007385 | 2 |
| OYSTER BAY | BAYVILLE | 405253 | 0733355 | S | 1 | MAGNOLIA VIRGINIANA | SWEET-BAY | PLANT | 1992 | C | U | | G5 | S1 | 4007385 | 4 |
| OYSTER BAY | BAYVILLE | 405431 | 0733332 | M | 0 | SPOROBOLUS CLANDESTINUS | ROUGH RUSH-GRASS | PLANT | 1925 | H | U | | G5 | S1 | 4007385 | 5 |
| OYSTER BAY | HICKSVILLE SEA CLIFF | 405052 | 0733710 | M | 0 | AGRIMONIA ROSTELLATA | WOODLAND AGRIMONY | PLANT | 1928 | H | R | | G5 | S2S3 | 4007375 | 8 |
| OYSTER BAY | HICKSVILLE | 404854 | 0733550 | S | 1 | CYPERUS ODORATUS | RUSTY FLATSEDGE | PLANT | 1987 | C | U | | G5 | S2S3 | 4007375 | 2 |
| OYSTER BAY | SEA CLIFF | 405013 | 0733837 | M | 0 | ARISTOLOCHIA SERPENTARIA | VIRGINIA SNAKEROOT | PLANT | 1915 | H | U | | G5 | SH | 4007376 | 2 |
| OYSTER BAY | SEA CLIFF | 405013 | 0733837 | M | 0 | SOLIDAGO ERECTA | SLENDER GOLDENROD | PLANT | 1938 | H | U | | G5 | SH | 4007376 | 2 |
| OYSTER BAY | SEA CLIFF HICKSVILLE | 405026 | 0733733 | M | 0 | TRIOSTEUM ANGUSTIFOLIUM | FEVERWORT | PLANT | 1929 | H | U | | G5 | SX | 4007376 | 15 |

* QUEENS

BIOLOGICAL AND CONSERVATION DATA SYSTEM - ELEMENT OCCURRENCE REPORT, 06 OCT 1994
Prepared by N.Y.S.D.E.C NATURAL HERITAGE PROGRAM

(This report contains sensitive information which should be treated in a sensitive manner. Refer to the Users Guide for explanation of codes and ranks.)

| COUNTY AND TOWN NAME | USGS 7 1/2' TOPOGRAPHIC MAP | LAT. | LONG. | PREC-ISION | SIZE (acres) | SCIENTIFIC NAME | COMMON NAME | ELEMENT TYPE | LAST SEEN | EO RANK | NYS STATUS | FED. STATUS | GLOBAL RANK | STATE RANK | OFFICE | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CITY OF NEW YORK | FLUSHING | 404747 | 0734738 | S | 1 | FALCO PEREGRINUS | PEREGRINE FALCON | VERTEBRATE | 1991 | E | E | E/SA | G3 | S2 | 4007377 | 4 |
| CITY OF NEW YORK | FLUSHING | 404602 | 0734637 | M | 0 | CAREX TYPHINA | CAT-TAIL SEDGE | PLANT | 1921 | H | R | | G5 | S1S2 | 4007377 | 18 |
| * WESTCHESTER | | | | | | | | | | | | | | | | |
| CITY OF NEW ROCHELLE | MOUNT VERNON | 405342 | 0734611 | S | 1 | MARINE ROCKY INTERTIDAL | MARINE ROCKY INTERTIDAL | COMMUNITY | 1990 | BC | U | | G5 | S1S2 | 4007387 | 20 |
| CITY OF NEW ROCHELLE | MOUNT VERNON | 405314 | 0734607 | S | 12 | MARINE ROCKY INTERTIDAL | MARINE ROCKY INTERTIDAL | COMMUNITY | 1991 | B | U | | G5 | S1S2 | 4007387 | 25 |
| CITY OF NEW ROCHELLE | MOUNT VERNON | 405314 | 0734525 | S | 9 | MARINE ROCKY INTERTIDAL | MARINE ROCKY INTERTIDAL | COMMUNITY | 1991 | AB | U | | G5 | S1S2 | 4007387 | 13 |
| CITY OF NEW ROCHELLE | MOUNT VERNON | 405314 | 0734525 | S | 6 | CASMERODIUS ALBUS | GREAT EGRET | VERTEBRATE | 1987 | E | P | | G5 | S2 | 4007387 | 13 |
| CITY OF NEW ROCHELLE | MOUNT VERNON | 405314 | 0734525 | S | 6 | EGRETTA THULA | SNOWY EGRET | VERTEBRATE | 1987 | E | P | | G5 | S2S3 | 4007387 | 13 |
| CITY OF NEW ROCHELLE | MOUNT VERNON | 405314 | 0734525 | S | 6 | PHALACROCORAX AURITUS | DOUBLE-CRESTED CORMORANT | VERTEBRATE | 1987 | E | P | | G5 | S2 | 4007387 | 13 |
| CITY OF NEW ROCHELLE | MOUNT VERNON | 405348 | 0734619 | M | 0 | CIRSIUM ALTISSIMUM | TALL THISTLE | PLANT | 1876 | H | U | | G5 | SX | 4007387 | 2 |
| CITY OF NEW ROCHELLE | MOUNT VERNON | 405314 | 0734525 | S | 6 | GULL NESTING COLONY | GULL NESTING COLONY | OTHER | 1987 | E | U | | | | 4007387 | 13 |

BIOLOGICAL AND CONSERVATION DATA SYSTEM - ELEMENT OCCURRENCE REPORT, 06 OCT 1994
Prepared by N.Y.S.D.E.C NATURAL HERITAGE PROGRAM

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| COUNTY AND TOWN NAME | USGS 7 1/2' TOPOGRAPHIC MAP | LAT. | LONG. | PREC-ISION | SIZE (acres) | SCIENTIFIC NAME | COMMON NAME | ELEMENT TYPE | LAST SEEN | EO RANK | NYS STATUS | FED. STATUS | GLOBAL RANK | STATE RANK | OFFICE | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CITY OF RYE | MAMARONECK | 405831 | 0733931 | S | 3 | MARINE ROCKY INTERTIDAL | MARINE ROCKY INTERTIDAL | COMMUNITY | 1990 | B | U | | G5 | S1S2 | 4007386 | 11 |
| CITY OF RYE | MAMARONECK | 405748 | 0734038 | M | 0 | AMARANTHUS PUMILUS | SEABEACH AMARANTH | PLANT | | X | U | LT | G2 | S1 | 4007386 | 9 |
| MAMARONECK | MAMARONECK | 405707 | 0734307 | M | 0 | CYPERUS FLAVESCENS VAR FLAVESCENS | CYPERUS | PLANT | 1936 | H | U | | G?T? | S1 | 4007386 | 6 |
| MAMARONECK CITY OF NEW ROCHELLE | MOUNT VERNON | 405447 | 0734521 | M | 0 | GAVIA IMMER | COMMON LOON | VERTEBRATE | | E | P SC | | G5 | S3S4 | 4007387 | 17 |
| MAMARONECK CITY OF NEW ROCHELLE | MOUNT VERNON | 405450 | 0734527 | S | 65 | ANADROMOUS FISH CONCENTRATION AREA | ANADROMOUS FISH CONCENTRATION AREA | OTHER | 1986 | E | U | | | | 4007387 | 14 |
| MAMARONECK CITY OF NEW ROCHELLE | MOUNT VERNON | 405447 | 0734544 | M | 0 | WATERFOWL CONCENTRATION AREA | WATERFOWL CONCENTRATION AREA | OTHER | | E | U | | | | 4007387 | 15 |
| RYE | MAMARONECK | 405705 | 0734150 | S | 20 | AMMODRAMUS MARITIMUS | SEASIDE SPARROW | VERTEBRATE | 1989 | E | P | | G4 | S2S3 | 4007386 | 3 |
| RYE | MAMARONECK | 405644 | 0734217 | M | 0 | NYCTANASSA VIOLACEA | YELLOW-CROWNED NIGHT-HERON | VERTEBRATE | 1985 | F | P | | G5 | S2 | 4007386 | 7 |
| RYE | MAMARONECK | 405703 | 0734203 | M | 0 | RAPTOR CONCENTRATION AREA | RAPTOR CONCENTRATION AREA | OTHER | | E | U | | | | 4007386 | 1 |
| RYE | MAMARONECK | 405652 | 0734210 | S | 0 | WATERFOWL CONCENTRATION AREA | WATERFOWL CONCENTRATION AREA | OTHER | 1985 | E | U | | | | 4007386 | 2 |

BIOLOGICAL AND CONSERVATION DATA SYSTEM - ELEMENT OCCURRENCE REPORT, 06 OCT 1994

Prepared by N.Y.S.D.E.C NATURAL HERITAGE PROGRAM

103165

(This report contains sensitive information which should be treated in a sensitive manner. Refer to the Users Guide for explanation of codes and ranks.)

| COUNTY AND TOWN NAME | USGS 7 1/2' TOPOGRAPHIC MAP | LAT. | LONG. | PREC-ISION | SIZE (acres) | SCIENTIFIC NAME | COMMON NAME | ELEMENT TYPE | LAST SEEN | EO RANK | NYS STATUS | FED. STATUS | GLOBAL RANK | STATE RANK | OFFICE | USE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RYE | MAMARONECK | 405814 | 0734009 | S | 200 | WATERFOWL CONCENTRATION AREA | WATERFOWL CONCENTRATION AREA | OTHER | 1985 | E | U | | | | 4007386 | 8 |

52 Records Processed

Rdb 38
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SIGNIFICANT HABITATS

DATE : 10/06/94

| REPORT ID# | NAME OF AREA | TYPE OF AREA | COUNTY | TOWN OR CITY | QUADRANGLE | LATITUDE (DEG MIN SEC) | LONGITU |
|---|---|---|---|---|---|---|---|
| SW 03-001 | Whitestone Bridge to Bronx/West. Co. Line | Waterfowl Wintering Area | Bronx | Bronx - New York City | Flushing | 40 50 41 | 73 47 5 |
| SW 03-002 | City Island and Vicinity | Waterfowl Wintering Area | Bronx | Bronx - New York City | Flushing | 40 51 53 | 73 48 3 |
| SB 30-002 | Sands Pt. Village Beach - Prospect Pt. Marsh | Wildlife Observation Area | Nassau | North Hempstead | Sea Cliff | 40 52 09 | 73 43 0 |
| SW 30-005 | Millneck Creek - Locust Valley Shore | Wildlife Observation Area | Nassau | Oyster Bay | Bayville | 40 53 38 | 73 35 4 |
| SW 30-006 | Dosoris Pond | Waterfowl Wintering Area | Nassau | Oyster Bay | Mamaroneck | 40 53 45 | 73 37 4 |
| SW 30-007 | Manhassett Bay | Waterfowl Nesting Area | Nassau | North Hempstead | Sea Cliff | 40 49 56 | 73 43 5 |
| SW 30-009 | Hempstead Harbor | Waterfowl Nesting Area | Nassau | North Hempstead | Sea Cliff | 40 50 58 | 73 39 4 |
| SW 30-012 | Manhasset Bay - Hempstead Bay (Mott Point) | Waterfowl Wintering Area | Nassau | North Hempstead | Sea Cliff | 40 52 05 | 73 42 1 |
| SW 30-013 | Glen Cove to Cold Spring Harbor | Waterfowl Wintering Area | Nassau | Oyster Bay | Bayville | 40 54 42 | 73 34 4 |
| SW 30-507 | Lloyd Harbor | Waterfowl Wintering Area | Nassau | Oyster Bay | Lloyd Harbor | 40 54 34 | 73 29 0 |
| SW 30-508 | Oyster Bay Harbor | Waterfowl Wintering Area | Nassau | Oyster Bay | Bayville | 40 53 28 | 73 32 0 |
| SW 30-509 | Mill Neck Creek Wetlands | Eagle Wintering Area | Nassau | Oyster Bay | Mamaroneck | 40 53 30 | 73 34 0 |
| SW 30-510 | Little Neck Bay | Waterfowl Wintering Area | Nassau | North Hempstead | Flushing | 40 47 25 | 73 45 4 |
| SW 41-012 | Whiteston Bridge to Little Neck Bay | Waterfowl Wintering Area | Queens | Queens - New York City | Flushing | 40 47 49 | 73 48 0 |
| SW 41-017 | Throg's Neck Bridge | Raptor Nesting Area | Queens | Queens - New York City | Flushing | 40 47 46 | 73 47 3 |
| SW 41-500 | Udalls Cove, Uplands, Little Neck Bay | Waterfowl Wintering Area | Queens | Queens - New York City | Flushing | 40 47 25 | 73 45 4 |
| SW 52-057 | Eaton's Neck Point | Tern Nesting Area | Suffolk | Huntington | Lloyd Harbor | 40 57 09 | 73 24 1 |
| SW 52-067 | Lloyds Neck | Tern Nesting Area | Suffolk | Huntington | Lloyd Harbor | 40 56 44 | 73 29 0 |
| SW 52-529 | Huntington Bay | Tern Nesting Area | Suffolk | Huntington | Lloyd Harbor | 40 54 59 | 73 23 4 |
| SW 52-530 | Lloyd Harbor | Waterfowl Wintering Area | Suffolk | Huntington | Huntington | 40 54 34 | 73 29 0 |

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9 of 10

# NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

## REGULATORY AFFAIRS REGIONAL OFFICES

| REGION | COUNTIES | NAME | ADDRESS AND PHONE NO. |
|---|---|---|---|
| Region 1 | Nassau<br>Suffolk | Robert Greene<br>Permit Administrator | Loop Road, Bldg. 40<br>SUNY<br>Stony Brook, NY 11790-2356<br>(516) 751-1389 |
| Region 2 | New York City | John Ferguson<br>Permit Administrator | Hunters Point Plaza<br>4740 21st Street<br>Long Island City, NY 11101-5407<br>(718) 482-4997 |
| Region 3 | Dutchess<br>Orange<br>Putnam<br>Rockland, Sullivan<br>Ulster, Westchester | Margaret Duke<br>Permit Administrator | 21 South Putt Corners Road<br>New Paltz, NY 12561-1696<br>(914) 256-3032 |
| Region 4 | Albany<br>Columbia<br>Delaware<br>Greene, Montgomery, Otsego<br>Rensselaer, Schenectady, Schoharie | William J. Clarke<br>Permit Administrator | 2176 Guilderland Avenue<br>Schenectady, NY 12306-4498<br>(518) 382-0680 |
| Region 5 | Clinton<br>Essex<br>Franklin<br>Fulton, Hamilton<br>Saratoga, Warren, Washington | Richard Wild<br>Permit Administrator | Route 86<br>Ray Brook, NY 12977<br>(518) 891-1370 |
| Region 6 | Herkimer<br>Jefferson<br>Lewis<br>Oneida, St. Lawrence | Randy Vaas<br>Permit Administrator | State Office Building<br>317 Washington Street<br>Watertown, NY 13601<br>(315) 785-2246 |
| Region 7 | Broome<br>Cayuga<br>Chenango<br>Cortland, Madison, Onondaga<br>Oswego, Tioga, Tompkins | Robert Torba<br>Permit Administrator | 615 Erie Blvd. West<br>Syracuse, NY 13204-2400<br>(315) 426-7439 |
| Region 8 | Chemung<br>Genesee<br>Livingston<br>Monroe, Ontario, Orleans<br>Schuyler, Seneca, Steuben<br>Wayne, Yates | Albert Butkas<br>Permit Administrator | 6274 East Avon-Lima Road<br>Avon, NY 14414<br>(716) 226-2466 |
| Region 9 | Allegany<br>Cattaraugus<br>Chautauqua<br>Erie, Niagara, Wyoming | Steven Doleski<br>Permit Administrator | 270 Michigan Avenue<br>Buffalo, NY 14203-2999<br>(716) 851-7165 |

AS.38
10 of 10

# USERS GUIDE TO NATURAL HERITAGE DATA

**DATA SENSITIVITY:** The data provided in these reports is sensitive and should be treated in a sensitive manner. The data is for your in-house use only and may not be released to the general public or incorporated in any public document without prior permission from the Natural Heritage Program.

**BIOLOGICAL AND CONSERVATION DATA SYSTEM ELEMENT OCCURRENCE REPORTS:**

COUNTY NAME: County where the element occurrence is located.
TOWN NAME: Town where the element occurrence is located.
USGS 7 1/2' TOPOGRAPHIC MAP: Name of 7.5 minute US Geological Survey (USGS) quadrangle map (scale 1:24,000).
LAT: Centrum latitude coordinates of the location of the occurrence. Important: latitude and longitude must be used with PRECISION (see below). For example, the location of an occurrence with M (minute) precision is not precisely known at this time and is thought to occur somewhere within a 1.5 mile radius of the given latitude/longitude coordinates.
LONG: Centrum longitude coordinates of the location of the occurrence. See also LAT above.
PRECISION: S - seconds: Location known precisely. (within a 300' or 1-second radius of the latitude and longitude given.
M - minutes: Location known only to within a 1.5 mile (1 minute) radius of the latitude and longitude given.
SIZE (acres): Approximate acres occupied by the element at this location.
SCIENTIFIC NAME: Scientific name of the element occurrence.
COMMON NAME: Common name of the element occurrence.
ELEMENT TYPE: Type of element (i.e. plant, community, other, etc.)
LAST SEEN: Year element occurrence last observed extant at this location.
EO RANK: Comparative evaluation summarizing the quality, condition, viability and defensibility of this occurrence. Use in combination with LAST SEEN and PRECISION.
A-E = Extant: A=excellent, B=good, C=marginal, D=poor, E=extant but with insufficiently data to assign a rank of A - D.
F = Failed to find. Did not locate species, but habitat is still there and further field work is justified.
H = Historic. Historic occurrence without any recent field information.
X = Extirpated. Field/other data indicates element/habitat is destroyed and the element no longer exists at this location.

NYS STATUS - animals: Categories of Endangered and Threatened species are defined in New York State Environmental Conservation Law section 11-0535. Endangered, Threatened, and Special Concern species are listed in regulation 6NYCRR 182.5.
E = Endangered Species: any species which meet one of the following criteria:
1) Any native species in imminent danger of extirpation or extinction in New York.
2) Any species listed as endangered by the United States Department of the Interior, as enumerated in the Code of Federal Regulations 50 CFR 17.11.
T = Threatened Species: any species which meet one of the following criteria:
1) Any native species likely to become an endangered species within the foreseeable future in NY.
2) Any species listed as threatened by the U.S. Department of the Interior, as enumerated in the Code of the Federal Regulations 50 CFR 17.11.
SC = Special Concern Species: those species which are not yet recognized as endangered or threatened, but for which documented concern exists for their continued welfare in New York. Unlike the first two categories, species of special concern receive no additional legal protection under Environmental Conservation Law section 11-0535 (Endangered and Threatened Species).
P = Protected Wildlife (defined in Environmental Conservation Law section 11-0103): wild game, protected wild birds, and endangered species of wildlife.
U = Unprotected (defined in Environmental Conservation Law section 11-0103): the species may be taken at any time without limit; however a license to take may be required.
G = Game (defined in Environmental Conservation Law section 11-0103): any of a variety of big game or small game species as stated in the Environmental Conservation Law; many normally have an open season for at least part of the year, and are protected at other times.

NYS STATUS - plants: The following categories are defined in regulation 6NYCRR part 193.3 and apply to New York State Environmental Conservation Law section 9-1503.
(blank) = no state status
E = Endangered Species: listed species are those with:
1) 5 or fewer extant sites, or
2) fewer than 1,000 individuals, or
3) restricted to fewer than 4 U.S.G.S. 7 1/2 minute topographical maps, or
4) species listed as endangered by U.S. Department of Interior, as enumerated in Code of Federal Regulations 50 CFR 17.11.
T = Threatened: listed species are those with:
1) 6 to fewer than 20 extant sites, or
2) 1,000 to fewer than 3,000 individuals, or
3) restricted to not less than 4 or more than 7 U.S.G.S. 7 and 1/2 minute topographical maps, or
4) listed as threatened by U.S. Department of Interior, as enumerated in Code of Federal Regulations 50 CFR 17.11.
R = Rare: listed species have:
1) 20 to 35 extant sites, or
2) 3,000 to 5,000 individuals statewide.
U = Unprotected
V = Exploitably vulnerable: listed species are likely to become threatened in the near future throughout all or a significant portion of their range within the state if causal factors continue unchecked.

NYS STATUS - communities: At this time there are no categories defined for communities.

continued on next page

REFEERNCE NO. 39

United States Department of the Interior

TAKE PRIDE IN AMERICA

FISH AND WILDLIFE SERVICE
3817 Luker Road
Cortland, New York 13045

October 12, 1994

Ms. Anne C. Roche
Risk Assessment/Environmental Chemist
Ebasco Services Incorporated
One Oxford Valley, Suite 200
2300 Lincoln Highway East
Langhorne, PA 19047-1829

Dear Ms. Roche:

This responds to your letter of September 26, 1994, requesting information on the presence of endangered or threatened species within a four mile radius of the Captain's Cove Condominium Site located in Glen Cove, Nassau County, New York.

The peregrine falcon (*Falco peregrinus*) is a Federally listed endangered species known to occur on the Throgs Neck Bridge, and may be found in the surrounding area. This project's environmental documents should, therefore, include an evaluation of the potential direct, indirect, and cumulative effects of specific project related activities on the peregrine falcon or its habitat, and include appropriate measures, if necessary, to protect this species and its habitat. When specific plans are identified, the plans and the results of the evaluation should be provided to this office to determine the need for further consultation pursuant to Section 7 of the Endangered Species Act of 1973 (87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.).

Except for the peregrine falcon, and occasional transient individuals, no other Federally listed or proposed endangered or threatened species under our jurisdiction are known to exist in the project impact area. Should project plans change, or if additional information on listed or proposed species becomes available, this determination may be reconsidered. A compilation of Federally listed and proposed endangered and threatened species in New York is enclosed for your information. A compilation of Federally listed and proposed endangered and threatened species in New York is enclosed for your information.

The above comments pertaining to endangered species under our jurisdiction are provided pursuant to the Endangered Species Act. This response does not preclude additional Service comments under the Fish and Wildlife Coordination Act or other legislation.

The Federally listed endangered shortnose sturgeon (*Acipenser brevirostrum*), as well as several listed marine mammals, may be found in Long Island waters near the project area. These species are under the jurisdiction of the National Marine Fisheries Service. You should contact Mr. Douglas W. Beach, National Marine Fisheries Service, Habitat Conservation Branch, One Blackburn Drive, Gloucester, Massachusetts 01930-2298.

For additional information on fish and wildlife resources or State-listed species, we suggest you contact:

New York State Department
of Environmental Conservation
Region 1
Building 40, SUNY
Stony Brook, NY 11794
(516) 444-0200

New York State Department
of Environmental Conservation
Wildlife Resources Center - Information Serv.
New York Natural Heritage Program
700 Troy-Schenectady Road
Latham, NY 12110-2400
(518) 783-3932

The National Wetlands Inventory (NWI) maps of the appropriate Quadrangles indicates that there may be wetlands in the project vicinity. Copies of NWI maps may be obtained through:

CLEARS
Cornell University
464 Hollister Hall
Ithaca, NY 14853
(607) 255-6520

An order form listing the topographic quadrangles that have been mapped in New York State is enclosed for your information. However, while the NWI maps are reasonably accurate, they should not be used in lieu of field surveys for determining the presence of wetlands or delineating wetland boundaries for Federal regulatory purposes.

Work in certain waters and wetlands of the United States may require a permit from the U.S. Army Corps of Engineers (Corps). If a permit is required, in reviewing the application pursuant to the Fish and Wildlife Coordination Act, the Service may concur, with or without stipulations, or recommend denial of the permit depending upon the potential adverse impacts on fish and wildlife resources associated with project implementation. The need for a Corps permit may be determined by contacting Mr. Joseph Seebode, Chief, Regulatory Branch, U.S. Army Corps of Engineers, 26 Federal Plaza, New York, NY 10278 (telephone: [212] 264-3996).

If you have any questions regarding this letter, contact Tom McCartney at (607) 753-9334.

Sincerely,

for John T. Hickey
David A. Stilwell
Acting Field Supervisor

Enclosures

cc: NYSDEC, Stony Brook, NY (Regulatory Affairs)
NYSDEC, Latham, NY
COE, New York, NY
EPA, Chief, Marine & Wetlands Protection Branch, New York, NY
NMFS, Gloucester, MA

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# FEDERALLY LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES IN NEW YORK

| Common Name | Scientific Name | Status | Distribution |
|---|---|---|---|
| **FISHES** | | | |
| Sturgeon, shortnose* | *Acipenser brevirostrum* | E | Hudson River & other Atlantic coastal rivers |
| **REPTILES** | | | |
| Turtle, green* | *Chelonia mydas* | T | Oceanic summer visitor coastal waters |
| Turtle, hawksbill* | *Eretmochelys imbricata* | E | Oceanic summer visitor coastal waters |
| Turtle, leatherback* | *Dermochelys coriacea* | E | Oceanic summer resident coastal waters |
| Turtle, loggerhead* | *Caretta caretta* | T | Oceanic summer resident coastal waters |
| Turtle, Atlantic ridley* | *Lepidochelys kempii* | E | Oceanic summer resident coastal waters |
| **BIRDS** | | | |
| Eagle, bald | *Haliaeetus leucocephalus* | E | Entire state |
| Falcon, peregrine | *Falco peregrinus* | E | Entire state - re-establishment to former breeding range in progress |
| Plover, piping | *Charadrius melodus* | E<br>T | Great Lakes Watershed<br>Remainder of coastal New York |
| Tern, roseate | *Sterna dougallii dougallii* | E | Southeastern coastal portions of state |
| **MAMMALS** | | | |
| Bat, Indiana | *Myotis sodalis* | E | Entire state |
| Cougar, eastern | *Felis concolor couguar* | E | Entire state - probably extinct |
| Whale, blue* | *Balaenoptera musculus* | E | Oceanic |
| Whale, finback* | *Balaenoptera physalus* | E | Oceanic |
| Whale, humpback* | *Megaptera novaeangliae* | E | Oceanic |
| Whale, right* | *Eubalaena glacialis* | E | Oceanic |
| Whale, sei* | *Balaenoptera borealis* | E | Oceanic |
| Whale, sperm* | *Physeter catodon* | E | Oceanic |
| **MOLLUSKS** | | | |
| Snail, Chittenango ovate amber | *Succinea chittenangoensis* | T | Madison County |
| Mussel, dwarf wedge | *Alasmidonta heterodon* | E | Orange County - lower Neversink River |

* Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service.

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# FEDERALLY LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES IN NEW YORK (Cont'd)

| Common Name | Scientific Name | Status | Distribution |
|---|---|---|---|
| BUTTERFLIES | | | |
| Butterfly, Karner blue | *Lycaeides melissa samuelis* | E | Albany, Saratoga, Warren, and Schenectady Counties |
| PLANTS | | | |
| Monkshood, northern wild | *Aconitum noveboracense* | T | Ulster, Sullivan, and Delaware Counties |
| Pogonia, small whorled | *Isotria medeoloides* | E | Entire state |
| Swamp pink | *Helonias bullata* | T | Staten Island - presumed extirpated |
| Gerardia, sandplain | *Agalinis acuta* | E | Nassau and Suffolk Counties |
| Fern, American hart's-tongue | *Phyllitis scolopendrium* var. *americana* | T | Onondaga and Madison Counties |
| Orchid, eastern prairie fringed | *Platanthera leucophea* | T | Not relocated in New York |
| Bulrush, northeastern | *Scirpus ancistrochaetus* | E | Not relocated in New York |
| Roseroot, Leedy's | *Sedum integrifolium* ssp. *Leedyi* | T | West shore of Seneca Lake |
| Amaranth, seabeach | *Amaranthus pumilus* | T | Atlantic coastal plain beaches |

E=endangered T=threatened P=proposed

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REFEERNCE NO. 40

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LONG ISLAND SOUND STUDY

# PRINCIPAL FISHERIES OF LONG ISLAND SOUND 1961-1985

**State of Connecticut**
**Department of Environmental Protection**
**Division of Conservation & Preservation**
**Bureau of Fisheries**
**Marine Fisheries Program**

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INTRODUCTION

This report is intended to summarize fishery statistics for the principal commercial fisheries of Long Island Sound during the period 1961-1985. A related objective is to describe the recent sport fisheries for the same species. Intermittent fisheries, which may have been of great magnitude but for only a few years (e. g. the dredge fishery for surf clams in 1985-86, the industrial fishery for menhaden with purse seines), are not included. The project was funded by the Connecticut Department of Environmental Protection, Division of Conservation & Preservation, and by the Management Committee of the Long Island Sound Study through grants administered by the U. S. Environmental Protection Agency and the National Marine Fisheries Service of the U. S. Department of Commerce, National Oceanic and Atmospheric Administration.

In emphasizing 14 principal species, it is not our intent to suggest that they are the only ones of importance. Over 35 species of finfish, shellfish and crustaceans constitute the potential foodfish resources of the Sound and a number of others may be utilized exclusively as bait; depending on the year, over two dozen species support the commercial and recreational food and bait fisheries of the Sound. Our charge was to present as detailed a description as possible of the fisheries for selected species to gain insight into the dynamics and environmental quality of Long Island Sound. In doing so, we found that these 14 were the major or most representative fisheries of the period.

The effort has been accomplished by reviewing the National Marine Fisheries Service (NMFS) data base of commercial landings by water body, by integrating more useful state fishery statistics where available, by interpolating values for missing data, and by evaluating the quality of the resulting data by interviewing persons familiar with the fisheries. Information on sport fisheries has been included for the period 1981-1985 to illustrate the magnitude of these fisheries during the most recent five years of the 25-year period.

The project was proposed because commercial fishery statistics traditionally have been published as "landings by state" rather than "catch by water body." While landings by state are more useful in economic evaluations of fishery production, catch by water body may be a more useful indicator of the condition of that water body. While the quality of catch by water body data is less dependable than landings data, it is the catch from the Sound, and, potentially, what it may suggest about trends in water quality, that is most important to participants in the Long Island Sound Study. However, a great deal of caution must be exercised in attempting to correlate landings to trends in water quality since many other factors — fishing effort, supply and demand for fishery products, regulation changes, resource use conflicts and subsequent restrictions on the fisheries, changes in fuel prices and other operational costs — all can have a substantial influence on commercial fishing activity.

Marine recreational fisheries information has been included because of the growing recognition that sport fisheries exploit some marine fish species to a far greater extent than do commercial fisheries. Because reporting commercial landings alone would present a misleading picture of total exploitation, sport catches have been included for those years in which a continuous time series of data are available. Unfortunately, methods of data collection vary greatly between sport and commercial fishery statistics programs making comparisons of the absolute magnitude of the fisheries difficult to accomplish. Since reporting sport catches in the same tables and figures as commercial catches might suggest an equivalent confidence in the quality of the statistics, we have opted to summarize sport catches within the text presented for each species. Where appropriate, the average annual sport catch has been referenced in the landings figures to illustrate the relative magnitude of the fishery.

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One of the more frustrating features of commercial fishery statistics systems during the past 25 years is that water body boundaries have changed a number of times. The result of this observation is that great care must be taken when interpreting trends in Long Island Sound fisheries over the entire period. Similarly, while National Hunting & Fishing Surveys (U. S. Dept. of Interior) were conducted every five years from 1955-1985, these results are not applicable to Long Island Sound. Moreover, the methods used in the five-year surveys and the current Marine Recreational Fisheries Statistics Survey conducted annually by NMFS differ greatly and results are not comparable. For this reason, only NMFS results are reported here.

Certain fisheries have been excluded intentionally. The fishery for menhaden, while a large one, was omitted since the data were rather incomplete and of questionable quality and since, as an industrial rather than food fishery, the species is a unique and anomalous contributor to the fisheries of the Sound. Surf clams supported an important fishery in the New York waters of Long Island Sound for a few years in the mid-1980's but rapidly declined. The species traditionally supported a small bait fishery in the Sound but the rapid growth in the 1980's was as a food fishery on a virgin resource, due to complex economic factors conducive to a "pulse" fishery. Since it was not a consistent contributor to landings during the 25-year time series, it, too, has been excluded. Bait fisheries, in general, have not been considered since the landings of non-foodfish resources traditionally have been given less attention in statistical compilations than have food fisheries. Unfortunately, this results in fishery events being missed (e. g. the reported enormous increase in the sand eel, <u>Ammodytes americanus</u>, population in the late 1970's which supported a bait seine fishery in New York). Other bait fisheries (e. g. the lobster bait fisheries for menhaden with gill nets, or windowpane flounders, sea robins etc. taken by trawls) have also largely gone unrecorded.

The following section describes the methods by which fishery statistics have been utilized in compiling this document. Major results are presented in Part One following a description of statistics systems, an analysis of data quality and a description of relative fishing effort. The results are reported as a table and two figures for each of 14 principal species taken from Long Island Sound during the period 1961-1985. They summarize landings of fishery catches of species taken from the Sound regardless of where those landings were made.

In Part Two, landings in five year intervals are presented to illustrate trends independent of interannual variations. Fishing effort is described on page seven; fishing gear data are summarized in Appendix One. Appendix Two presents catch per unit of fishing effort for six key species from 1979-1985. Appendix Three provides a variety of sport fishery effort statistics while Appendix Four summarizes our methods of data synthesis.

## METHODS

Landings of catches taken from Long Island Sound, by the gear used to take those catches, were obtained from the Resource Statistics Division of the National Marine Fisheries Service, U. S. Department of Commerce, National Oceanic and Atmospheric Administration, Washington, DC (NMFS). Other sources included <u>Fishery Statistics of the United States 1961 - 1977</u>, "Commercial Fisheries" New York Series No. 2520-4681, and unpublished Connecticut and New York state data from 1978-1985.

Interviews were conducted with persons having knowledge of Long Island Sound fisheries to interpret unexplained fluctuations in the data, to identify potential omissions, and to qualify the relative magnitude of the fisheries in comparison to the reported record. These included staff of the Connecticut Department of Environmental Protection (DEP) and the New York State Department of Environmental Conservation (DEC), NMFS port agents, and selected fishermen known to have fished the Sound during the 25 year period.

The first year for which NMFS commercial landings data specific to Long Island Sound (LIS) are available is 1962. To estimate 1961 LIS landings by gear type, the proportion of LIS landings to total state landings by gear type was determined for 1962-63, and that proportion was applied to 1961 total state landings by gear type for each state. This method was followed for each species.

The geographic demarcation between Long Island Sound and offshore waters has changed a number of times over the years. Long Island Sound landings were proportioned based on a demarcation as close as possible to a line running from Orient Point, New York to Stonington, Connecticut. For example, from 1981-85, Connecticut trawl fishery statistics were prorated to omit Block Island Sound from total Long Island Sound landings for each year in which landings from Block Island Sound had been aggregat-



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ed within the NMFS area encompassing eastern Long Island Sound. However, in some cases, such a determination was not possible, with the result that some landings of catches taken from areas just outside the Sound may be included in Long Island Sound totals (e. g. Gardiners and Peconic Bay fisheries).

Anomalous records (missing or low values) appeared to occur in years in which statistics systems or NMFS water body codes changed, such as in New York in 1972 and 1975 and Connecticut in 1975 and after 1980. Unfortunately, this fact is confounded by the recognition that 1974-76 seems to represent a low point in commercial fishing in Long Island Sound during the 25-year period. Consequently, the overlap of transitions in statistics systems and the decline of the fisheries makes interpretations of data from the mid-1970's extremely difficult.

The 1981-85 Connecticut anomaly has been corrected from data reported to Connecticut via a fishing trip ("logbook") reporting system whereby total state landings were prorated by the ratio of LIS catches to all reported catches by gear type and species. In all other cases, replacement values for single year omissions in the data base were interpolated by averaging the proportion of total state landings that were taken from Long Island Sound, by gear type, in the two years preceding and two years succeeding the missing observation. Where two consecutive years were missing, interpolations from observations three years above and three years below the missing years were used. Where records from more than two consecutive years were suspect, no more than four years preceding and four years succeeding the missing years were used. The average proportion was then multiplied by total state landings by gear type for the missing year (or years) to produce an estimate of the landings taken from Long Island Sound by that gear type. That is, for the missing year(s):

$$C = P(S)$$

where: C = Landings from Long Island Sound by a gear type in the missing year(s),
S = Total state landings by the gear type in the missing year(s), and
P = Average proportion of total state landings taken from Long Island Sound by a gear type in years prior to and succeeding the missing year(s).

Asterisks in the tables and figures in Part One identify interpolated values.

Marine recreational fisheries data were obtained from staff of the Marine Recreational Fisheries Statistics Survey (MRFSS), conducted since 1979 by the Office of Research and Environmental Information, NMFS, Washington, DC. Statistics for winter flounder, summer flounder, blackfish, bluefish, scup (porgy), mackerel, weakfish and striped bass were obtained for the period 1981-1985. The MRFSS produces statistics based on on-site interviews of anglers and a random telephone survey of U. S. households in "coastal counties" (any county within 25 miles of the coast). Although NMFS annual state-specific estimates of catch lack precision due to insufficient sample sizes for this purpose (coefficients of variation 50% or more), the statistics provide the most current, continuous and dependable data available to describe the relative magnitude of Connecticut and New York sport fisheries of the Sound, and therefore, they were used as the source for this study.

The mean weight of each species taken in each state's sport fishery was multiplied by the estimated numbers of fish taken by state to derive annual catch in pounds for each state ("number taken" refers to "landings" defined as MRFSS catch type "A + B1", see Appendix Four). Since water body-specific catches are not available, it was assumed that all Connecticut catches of the selected species and a proportion of New York catches were taken from Long Island Sound. The proportion was determined from the telephone survey responses of New York anglers to the question of location fished (e. g. "Sound" vs. other water bodies). This proportion ranged from 32-42%. Recent evaluations of the methods by which MRFSS statistics are now generated suggest that catches may be systematically overestimated by 25% or more. However, we have not adjusted the sport catches of finfish presented in Part One because discussions of the relative merits of various methods to calculate total catches are still underway (see "Note" in Appendix Four).

## DESCRIPTION OF COMMERCIAL FISHERY STATISTICS SYSTEMS

### National Marine Fisheries Service

The NMFS system of documenting commercial fishery statistics in New York is based on identifying landings made at major ports via a "weighout" system. Daily landings, value, and area of capture data from major fisheries and ports are collected at the point of landing. In addition, interviews



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with vessel operators at major ports are used to determine effort and a more detailed distribution of catch by area fished. Such statistics describe the performance of the offshore otter trawl fishery quite well, however, inshore fisheries and those conducted with gear types other than trawl nets are described less reliably. Lobster and molluscan shellfishery statistics generally are documented by state agencies and forwarded to NMFS. However, weighout slips also may be collected in ports covered in the weighout program.

Prior to 1981, NMFS port agents compiled Connecticut fishery statistics based on summary statistics prepared by the state fishery agency and based on the state system of data collection in use at the time. NMFS agents also occasionally obtained weighout and interview data at the port of Stonington (Connecticut's only offshore fishing "port") and were responsible for obtaining production statistics from the Connecticut shellfish industry. In 1981, the DEP began performing these services in a cooperative agreement with NMFS. While offshore catches are documented via an annual survey of dealers, Long Island Sound catches are recorded by the method described below. Catches taken from Long Island Sound and landed at ports other than Connecticut and New York ports (e. g. in Rhode Island and New Jersey) are also recorded via the NMFS weighout system to the extent that NMFS or the states collect landings data at those ports.

New York Department of Environmental Conservation

New York finfish catches from Long Island Sound are recorded by the NMFS method described above. Lobster catch statistics are reported by fishermen for a given year during the license renewal process in the subsequent year. Molluscan shellfish landings are collected from dealers by the DEC at monthly intervals and are then transmitted to the NMFS port agent.

Connecticut Department of Environmental Protection

From 1961-74, Connecticut statistics were generated from an annual report required of anyone permitted to fish with trawl nets, hand lines, traps and pots, gill nets, seines, or pound nets. This report consisted of pounds landed by species and gear type, and the value of the landings. Since landings were not reported by water body, such proportions were estimated. These data were provided to NMFS for the national compilation of statistics.

Connecticut commercial fishery statistics have been obtained since 1975 (for the lobster pot fishery) and 1977 (for the finfish trawl fishery) via a mandatory fishing trip reporting system. Under this system, license holders are required to record trip catch and effort by area fished in a "logbook" which is then submitted to the agency at the end of each month. Information from this Marine Fisheries Information System has been utilized to estimate Long Island Sound catches from total landings. Data from other fisheries are collected annually and sent to NMFS to be included in their national statistical references.

## A CRITICAL ANALYSIS OF DATA QUALITY

This section is intended to present a critical analysis of the quality of the data utilized in this report. Fishery statistics have been generated over the years with the best of intentions but not always with sufficient support to do the job properly. Moreover, the trend in quality is such that improvements have been relatively gradual but continuous, and generally unquantifiable over time. The reader must understand these weaknesses so that the information herein will not be misinterpreted.

As noted above, commercial fishery statistics systems depend, to one degree or another, on the submission or collection of catch or landing reports. To the extent that catch report information is included in the NMFS system, any biases associated with these reports are perpetuated in the NMFS data base. The method of data collection is an attempt to record all landings rather than to estimate them by statistical sampling procedures (as done in MRFSS sampling). One of the weaknesses of this approach is the inability to assess the precision of the estimates. As a result, reported commercial landing statistics are assumed to be measured without error.

Reporting systems are prone to two types of bias. These are problems of recall (forgetfulness), and problems of intentional underreporting. A trip reporting system may be successful in eliminating problems of recall but there is no solution to the problem of intentional underreporting, short of an aggressive public relations effort to convince responsible fishermen of the need for accurate statistics, and an equally aggressive law enforcement effort to penalize recalcitrants. For these reasons, commercial catch reports will always provide minimum estimates of fishery production.

The NMFS system relies on dealer landing records ("weighout slips") and personal interviews with a small number of fishermen; this may remove some bias of an intentional nature. Unfortunately, the NMFS system in the past has been prone to different biases, related mostly to small sample sizes and insufficient coverage of non-trawl or inshore fisheries. As a result, the data base available for analysis is replete with different methods and degrees of bias based on those methods. While the user may be forced to use the statistics as if they were collected by equivalent methods over the years, this is a false assumption.

Anomalies in Statistics Systems

Anomalies in NMFS statistics in the mid-1970's relate principally to water body code changes. In 1972, NMFS codes for New York were changed from a Long Island Sound code (11) and an offshore code (30) to an aggregate code which included Long Island Sound and western Block Island Sound (611). In 1975, NMFS reverted to an LIS code (11) and a new "outside LIS" code (611). For Connecticut landings, the LIS code (5) and an offshore code (22) were aggregated beginning in 1981 (611) but, in 1982, the distinction between the Sound and waters outside of the Sound was reinstated (611 and 539, respectively). Unfortunately, since the eastern demarcation of 611 includes much of Block Island Sound, some of the fishery production from that water body and the Gardiners Bay/Peconic Bay complex is included with Long Island Sound catches. To the extent that landings of "611" catches taken outside of Long Island Sound have been identified, they have been omitted (e. g. weakfish haul seine landings in New York, most Rhode Island trawl catches, Connecticut catches from Block Island Sound). The impact of water body code changes on data quality is unknown but a substantial number of data points were missing or appeared abnormally low during these "transition years," therefore, values were interpolated as described in "Methods."

A different type of anomaly is produced by changes in statutes or regulations authorizing the collection of fishery statistics. For example, until the late 1970's, trawl net fishermen fishing outside Long Island Sound and landing in Connecticut were not required to report their landings to the DEP; all fishermen fishing in Connecticut waters were required to report whether or not they landed in Connecticut, and fishermen licensed by Connecticut, and who might fish on a particular trip in the New York waters of the Sound, were encouraged to report. After 1980, many of these inconsistencies were clarified but, given the confusion over the differences, many who fished in the Sound, and were required to report, failed to do so, and many catches from the Sound that were not required to be reported were never documented in any system. Consequently, there is some possibility that reported trawl net landings of catches taken from Long Island Sound increased from the late 1970's into the early 1980's due simply to better reporting of those landings.

Changes in fishing regulations may result in perceptible differences in recorded statistics. For example, imposition of closed areas, if widespread, might have a significant effect on landings in subsequent years. The effects of minor increases in minimum fish lengths, although undoubtedly felt by individual fishermen, are very likely masked by interannual variations in recruitment and fishing effort. A number of such regulatory changes have occurred over time in both New York and Connecticut, however with the possible exception of bluefish (p. 28), attempts to relate changes in landings to changes in regulations were unsuccessful.

Finally, coding or processing errors in the data base can result in data errors. These errors are extremely difficult to identify, particularly after considerable time has elapsed. One such error was detected in the Connecticut data base, resulting from a computer update failure in May 1982. The consequence was that lobster and winter flounder landings for the year actually were higher than reported to NMFS; landings for other species were largely unaffected. Landings reported in this document for the two affected species have been corrected by interpolation from 1981 and 1983 data.

Although the principal objective of the present study was to provide a 25-year time series of commercial fisheries information, we felt that a total omission of sport fishery statistics would be misleading, particularly given the significance of recreational finfish catches for many of those species. However, as with commercial fishery statistics for the reasons noted above, the available sport fishery statistics suffer from a number of shortcomings. Annual state-specific estimates of catches lack precision due to insufficient sample sizes for this purpose (coefficients of variation 50% or more) and the statistics may be systematically overestimated. The Marine Recreational Fisheries Statistics Survey is the best iteration to date in continued attempts to develop a comprehensive sport fishery data base. However, the current time series only began in 1979, consequently, long-term temporal assessments are not possible and resource managers are left only with the recognition that sport catches of key species often far exceed commercial catches. Moreover, while National Hunting and Fishing Surveys (U. S. Fish & Wildlife Service) have been conducted at five-year intervals since 1955, and indicate the growth of the sport fishery on a coast-wide or national basis, the methods used in the five year surveys and MRFSS are inconsistent and water body-specific data (a particular need for the current project) are lacking in both.

Anecdotal Reference to the Magnitude of the Long Island Sound Trawl Fishery, 1961-1985

While not a quantitative method of analysis, interviews were conducted with a number of individuals knowledgeable about Long Island Sound fisheries in an attempt to confirm or deny the relative magnitude of the fisheries throughout the 25 year period, as reported in recorded fishery statistics. While established practice for scientists may be to believe the written word and suspect that which is spoken, and while there may be good reason to suspect anecdotes, there is also enough reason to suspect the quality of recorded statistics over time (through no fault of the collectors), and to justify a qualitative analysis for whatever advantage it may provide. Due to the predominance of the bottom trawl fishery as the gear used to take a number of finfish species, the discussion refers to this gear. The individuals surveyed included fishermen, biologists, statistics collection agents, and conservation officers.

A meeting held in Stony Brook, New York in April 1986 was the first attempt to qualify the relative trends in the fisheries. The meeting was attended by the two NMFS port agents responsible for New York statistics collections, and by staff of the New York DEC and Connecticut DEP. The most useful result of this meeting was that the growth of the lobster pot fishery in the mid-1960's appeared to be accurately described by the recorded fishery statistics. Participants were less certain that the finfish fisheries were as well documented.

The most complete verbal summary of the fisheries of Long Island Sound was provided by a commercial fisherman who was able to recall vessel sizes and names, owners, landing ports and fishing behavior. His recollections were later confirmed by others involved in the fisheries (in fact, the magnitude of some of the "confirming" comments exceeded those repeated here).

From his earliest recollection until the late 1960's, a number of trawlers routinely fished in Long Island Sound. Apparently, the intensive pot fishery for lobsters began in the mid-1960's, more or less coincident with a decline in the finfish trawl fishery from about 1965-69. Nine Connecticut trawlers of 40-75' in length were identified by vessel name and operator as fishing routinely in the Sound at this time. Another 12-15 vessels of 40-50' length were estimated to dock in, and fish from, the Greenport-Mattituck area although at least the Greenport vessels could be expected to fish outside of the Sound on a variable basis depending upon finfish abundance inside or outside the Sound. Generally, they would fish in the "bays" in the spring (e.g. Gardiners and Peconic Bays) and in Long Island Sound in the summer. In addition, approximately 16 vessels from Sheepshead Bay, Brooklyn could be expected to make exploratory excursions into the Sound in any given year and would stay for a variable period of time depending on species abundance inside vs. outside the Sound. His recollection was that "probably 40 trawlers fished the Sound relatively frequently, with transient vessels leaving for Bridgeport and Smithtown Bay in October-November and returning to Brooklyn to go winter whiting fishing." His estimate of the duration of the fishery each year was variable, from March through November to May through August. Finally, while it is known that Stonington vessels fished in the Sound on an intermittent basis, he was uncertain of the number or size of vessels and therefore, his estimates excluded that fleet.

One indicator of the decline of the fishery is that, in 1968, the owner of a packing dock in Mattituck closed and sold the property and those who did not own waterfront property and docks had to relocate. Consequently, most boats went elsewhere although it is uncertain whether they left the Sound. By 1970, only two trawlers were left in that port "and then the pot fishery took off leaps and bounds." His recollection is that from 1965-1972, fish abundance seemed to decline but the local fishermen were aware of, and benefited from the gradual recovery in the mid-1970's. Apparently, when fishermen from other areas were exploring the Sound, the local fishermen would "tie up" for a few days to suggest that conditions were poor. By the late 1970's, however, fishermen from other areas began to learn about the improved conditions and began to fish more regularly in the Sound. This compares rather favorably with inference from the recorded statistics that the strong year class of scup which entered the fishery in 1977-78 induced the return of trawlers to the Sound.

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As evidence of the magnitude of catches which could be made, he offered the following: "At times, a trawler could take 10,000 lbs. of blackfish per tow but, at 5¢ per pound there was no market for them so fishermen did not fish for them....flounder catches of 70-80 bushels (conservatively, 5,000 lbs. per tow) were not uncommon but, again, they often couldn't be sold....scup, in a good year, brought 5¢/lb. and two trailer trucks could be filled by 11:00 AM...in the 1960's, one fisherman took 10,000 lbs. of scup in one day..."

The reader is reminded that these are undocumented anecdotes which must be interpreted cautiously. Fishermen (both sport and commercial) often recall the best, most productive, or most successful fishing trips. This tendency is understandable since the event "stands out" in the observer's memory. Therefore, while anecdotes serve a purpose in identifying maxima, they can be misleading if used without question to infer the norm. However, as has been mentioned previously, there are also a number of flaws inherent in the recorded data and, if there is any basis at all in the anecdotes just recounted, one of those flaws is that the relative magnitude of the Long Island Sound bottom trawl fishery in the 1960's may have gone unrecorded. It is generally believed that the relative change noted from the 1960's to the 1970's is valid, that is, the fishery declined to a low point in the mid-1970's. This is supported by the recorded statistics, by one of the following anecdotes, and by the results of the meeting with New York DEC staff and NMFS port agents.

Connecticut Conservation Officers confirmed that trawl vessels from Stonington fished regularly in Long Island Sound in the 1960's because fish were perceived to be more abundant than in Block Island Sound or offshore waters. The trend in vessel sizes recalled during the conversation was enlightening. In the 1960's, there apparently were more vessels of 40-60' length than in the 1980's, but less in the 1970's relative to the 1980's. Relative to the 1980's, there appeared to be fewer boats in the 20-40' class in the 1960's and fewer still in the 1970's. In the early 1980's there were more vessels in the 60' and over class than in the 1960's or 1970's.

As one final anecdote relating to what may represent a rather substantial omission of finfish landings from the 1960's, another fisherman's personal observations of the level of fishing for black sea bass (Centropristis striata) at the time suggests landings in a ten week period by a minimum of seven boats from central Long Island Sound, of 200,000-500,000 lbs. However, both states' landings from all waters in this period (offshore and inshore fisheries) were of the same magnitude and it is known that the fishery was predominantly conducted south of Long Island. Moreover, if Long Island Sound catches of sea bass approached this level, the species would have ranked in the top three finfish summarized in this document yet sea bass landings do not even fall within the top nine finfish landed during the period. This supports the contention that landings recorded in the 1960's for the Long Island Sound trawl fishery (and perhaps other gears) are lower than those likely made.

## FISHING EFFORT

No historical summary of fishery statistics would be complete without a description of the effort used to produce the landings. In fact, a landings summary without concomitant effort statistics is of limited value (and may even mislead the user of the data) since nothing can be inferred about relative abundance or the wide range of variables which can influence the magnitude of landings (see Introduction). Unfortunately, the historical effort statistics available for our purposes are not very useful since, until recently in Connecticut, effort was never reported by water body, rather it was reported by state as "units of gear used." In the case of mobile fisheries, this is understandable since an individual vessel may make trips in a number of different areas during a year and, prior to the advent of computerized, trip-specific data recording methods, such detail was impossible to accomplish. This fact poses significant problems to those attempting to relate historical commercial landings to fishing effort.

Development of the Connecticut Marine Fisheries Information System since 1979 has resulted in a data base of trawl fishery and lobster pot fishery catch and effort statistics by fishing area within Long Island Sound. Catches per unit of fishing effort derived from these data can be used as an index of relative abundance (Appendix Two).

The commercial fishing gear data reported in Tables A-1 through A-10 refer to the units of gear reported statewide on all boats and vessels recorded as having been used by New York and Connecticut fishermen, regardless of the area they fished. The tables are not specific to Long Island Sound, therefore, they can only be used in a



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general sense to describe regional rather than water body-specific trends in fishing gear used. In some cases, the reported vessel and boat data represent NMFS staff interpretations based on the number of licenses or permits issued by state licensing authorities.

As a generalization, the gear tables which are most likely to accurately describe Long Island Sound area[1] commercial fisheries over the 25-year period are those which relate to inshore or fixed gear fishing effort. These include: 1) Tables A-1 and A-2 lobster and conch pots, 2) Table A-3 oyster dredge, 3) Tables A-5 and A-6, tongs and grabs, and rakes, and 4) Table A-7 pound nets. This is a generalization only, since the effort in certain fisheries (e. g. inshore shellfisheries in New York) may have been heavily influenced during the 25-year period by fishing in the south shore bays.

Haul seines and fykes were not used to any great extent in Long Island Sound so they have not been included in the gear tables. Although they are a widely used commercial finfish gear, otter trawl gear units are not a good index of effort prior to 1979. Due to their mobility, trawl vessels can be (and have been) used to a variable degree in both inshore and offshore waters during the same year and this makes their use as an index of relative fishing effort in the Sound impossible. Pound nets have been used throughout the 25-year period on eastern Long Island in the Sound and in the Gardiners/Peconic Bay complex. Consequently, they have value as an indicator of fishing effort for pelagic species. Gill nets were used in Connecticut but, as a rule, New York effort with this gear occurred predominantly outside the Sound in the Gardiners/Peconic Bay complex and along the south shore of Long Island. Commercial hand line effort (single or multiple hook "hook & line" gear Table A-9) almost certainly underestimates the magnitude of this fishery since it is difficult to differentiate the catch of commercial anglers from that of sport anglers. This may result in commercial landings which go unrecorded in traditional fishery statistics. The angler fishery may also present an over-reporting bias because marketed angler catches may be counted inadvertently in the MRFSS if the angler misrepresents what he intends to do with his catch (MRFSS samplers ask if the catch will be sold; if so, the angler is not interviewed).

Oyster dredge gear was used predominantly in western Long Island Sound and the Gardiners/Peconic Bay complex, making it a relatively useful indicator of effort. However, the growth of transplanting and "relaying" activities during the period may mask the usefulness of this gear type as an indicator of effort expended for naturally-occurring shellfish. Clam dredge gear was used predominantly in the south shore New York bays and to a lesser and variable extent, in Long Island Sound bays. As a consequence, this gear is not a good reflection of shellfishing effort in the Sound.

Lobster pots are a relatively useful indicator of lobstering effort for a number of reasons. First, the fishery began to grow to its present proportions after the early 1960's so the 25-year time series reflects both its prior and current magnitude. Second, since the species has been taken throughout the period principally with traps, landings are not biased by gear mobility. Third, while the advent of the offshore lobster trap fishery occurred in the 1960's, it is known that gross offshore fishing effort (number of vessels, number of pots) from Connecticut and New York ports has always been low relative to the Long Island Sound fishery. Consequently, relatively dependable trends in lobster fishing effort can be inferred from the data presented in this report.

No time series of recreational fishery effort is available for the 25-year study period. Sport fishing effort from 1979-1985 is presented in Appendix Three. Given the inability to identify the water body in which trips were made, several estimators have been provided. These are: 1) Connecticut trips; 2) New York trips; 3) North Atlantic regional fishing effort (trips); 4) Mid-Atlantic regional fishing effort (trips); and 5) a computed "Long Island Sound" number of fishing trips.

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[1] "Long Island Sound area" in this context includes the waters of Long Island Sound, Gardiners Bay and the Peconic Bays since there is no better method to distinguish effort by water body.

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## CONCLUSION

In conclusion, there seems to be sufficient reason to suggest that commercial finfish landings of catches taken from the Sound during the 1960's may have been greater than those recorded, that they declined from the late 1960's through the early 1970's, and began to recover in the late 1970's. Paralleling the increase in commercial finfish catches in the 1980's is the growth of the sport fishery and the enormous significance of sport catches of the principal species supporting the finfish fisheries of the Sound.

Shellfish landings (oysters, hard clams) have increased steadily since the mid-1970's, due predominantly to increased cultivation, transplanting and relaying programs. As a result, possible trends in natural resource productivity may be masked by increases resulting from improved aquaculture practices. Lobsters taken with pots or traps represent the third major commercial fishery of Long Island Sound and may provide the most accurate representation of fishery trends, for the reasons noted previously.

Our intent was to describe the fisheries of the 25-year period for comparison to the implementation of the Clean Water Act in the early 1970's. However, the lack of information which can be used to accurately describe the relative magnitude of the fisheries prior to the early 1970's has made this objective impossible to accomplish with any confidence. What can be established is that there have been substantial improvements in water quality since the early 1970's as a result of water pollution control programs (e. g. upgrading from primary to secondary sewage treatment, requiring "BAT" (Best Available Technology) at all sources of industrial discharge to Long Island Sound, its tributaries, and municipal sewage treatment systems).

There is also little question that the magnitude of the Sound's principal fisheries in the 1980's far surpasses that of the 1970's. Although the trend in most fishery landings has almost certainly resulted from increases in fishing effort, that effort may have resulted from an increase in resource abundance stimulated, perhaps, by an improvement in water quality. Unfortunately, without definitive catch per unit of effort or survey indices, it is impossible to determine Sound-wide relative resource abundances prior to the late 1970's; whether or not the recently observed increases have resulted, in part, from improvements in water quality is a subject for continued speculation.

## CRUSTACEA

**American lobster (*Homarus americanus*)**

## MOLLUSCAN SHELLFISH

**American oyster (*Crassostrea virginica*)**
**Hard clam (*Mercenaria mercenaria*)**
**Conch (*Busycon canaliculatum*)**
**Long-finned squid (*Loligo pealii*)**

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## PART ONE

LANDINGS OF THE PRINCIPAL FOURTEEN SPECIES

OF FINFISH, SHELLFISH, AND CRUSTACEA

TAKEN FROM LONG ISLAND SOUND DURING THE PERIOD 1961-1985

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## American lobster
(<u>Homarus americanus</u>)

The lobster is one of the dominant species of the commercial fisheries of Long Island Sound, with landings of 750,000 lbs. or more annually since 1970. It is also one of the most economically important species, with ex-vessel (dockside) values ranging from $2.00 to $3.00 per pound from the 1970's to the 1980's. Finally, the fishery supports the greatest number of commercial fishermen, with current estimates of about 1,000 fishermen deriving all or a part of their income from lobstering.

The lobster pot was the principal gear used to take lobsters from Long Island Sound between 1961-1985. During the mid-1960's to early 1970's small quantities were taken with trawl nets and, in the late 1970's, trawl net catches increased, to a record high in 1984. The only other gear reported was commercial SCUBA in New York, from 1978 to the present. Peak landings by pots and trawl nets in the early to mid-1980's resulted from an extremely abundant resource, most likely emanating from the 1977 or 1978 year classes.

A number of difficulties were encountered in interpreting lobster statistics from the two states since, given the enormous importance of the resource to the fisheries of both, considerable attention has been given to statistical data for the species. The result of this attention is that in many cases, more comprehensive statistics are available than those found in the NMFS landings data; where such "better data" are available, they have been integrated within these results.

As with all species, gear-specific landings data were not reported by water body for either state until 1962; 1961 values were interpolated from 1962-63 data. Except for 1965, New York trawl net statistics were missing from 1961-1976; given this length of time, no interpolation was attempted. A thorough evaluation of 1965-1976 New York lobster catches was made by New York DEC staff in the late 1970's. NMFS lobster landings for New York's Long Island Sound fishery have been increased based on this evaluation. From 1977-1985, DEC landing statistics for lobster have been substituted for NMFS weighout data since they are higher, and, therefore, likely to be more accurate. From 1972-74, NMFS data were missing; values have been interpolated. From 1978-1985, New York commercial diving statistics from DEC have been included.

Recreational catches are not reported in the MRFSS, however, both Connecticut and New York require catch reports of sport divers and recreational potters. Reported recreational catches from Long Island Sound in 1985 totaled about 105,000 lbs., 13% of which were taken by divers.

COMMERCIAL LANDINGS OF AMERICAN LOBSTERS TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

| | GEAR TYPE | | | |
|---|---|---|---|---|
| YEAR | POTS (TRAPS) | OTTER TRAWL | DIVING | TOTAL LANDINGS |
| 1961 | 94,200* | | | 94,200* |
| 1962 | 94,500 | 400 | | 94,900 |
| 1963 | 102,900 | | | 102,900 |
| 1964 | 145,700 | 500 | | 146,200 |
| 1965 | 284,800 | 5,000 | | 289,800 |
| 1966 | 434,300 | 1,300 | | 435,600 |
| 1967 | 543,700 | 900 | | 544,600 |
| 1968 | 576,700 | 100 | | 576,800 |
| 1969 | 658,800 | 1,000 | | 659,800 |
| 1970 | 854,900 | 100 | | 855,000 |
| 1971 | 988,300 | 700 | | 989,000 |
| 1972 | 1,033,200* | | | 1,033,200* |
| 1973 | 932,900* | | | 932,900* |
| 1974 | 969,800* | | | 969,800* |
| 1975 | 877,500 | | | 877,500 |
| 1976 | 766,300 | | | 766,300 |
| 1977 | 960,000 | 400 | | 960,400 |
| 1978 | 1,159,000 | 4,000 | 300 | 1,163,300 |
| 1979 | 1,162,700 | 5,100 | 1,000 | 1,168,800 |
| 1980 | 1,213,600 | 7,000 | 600 | 1,221,200 |
| 1981 | 1,213,700 | 11,700 | 200 | 1,225,600 |
| 1982 | 1,532,100 | 38,400 | 200 | 1,570,700 |
| 1983 | 2,271,800 | 93,100 | 300 | 2,365,200 |
| 1984 | 2,688,200 | 146,100 | 800 | 2,835,100 |
| 1985 | 2,396,900 | 99,500 | 500 | 2,496,900 |

[1] landings reported in pounds (lbs.)
* interpolated values included

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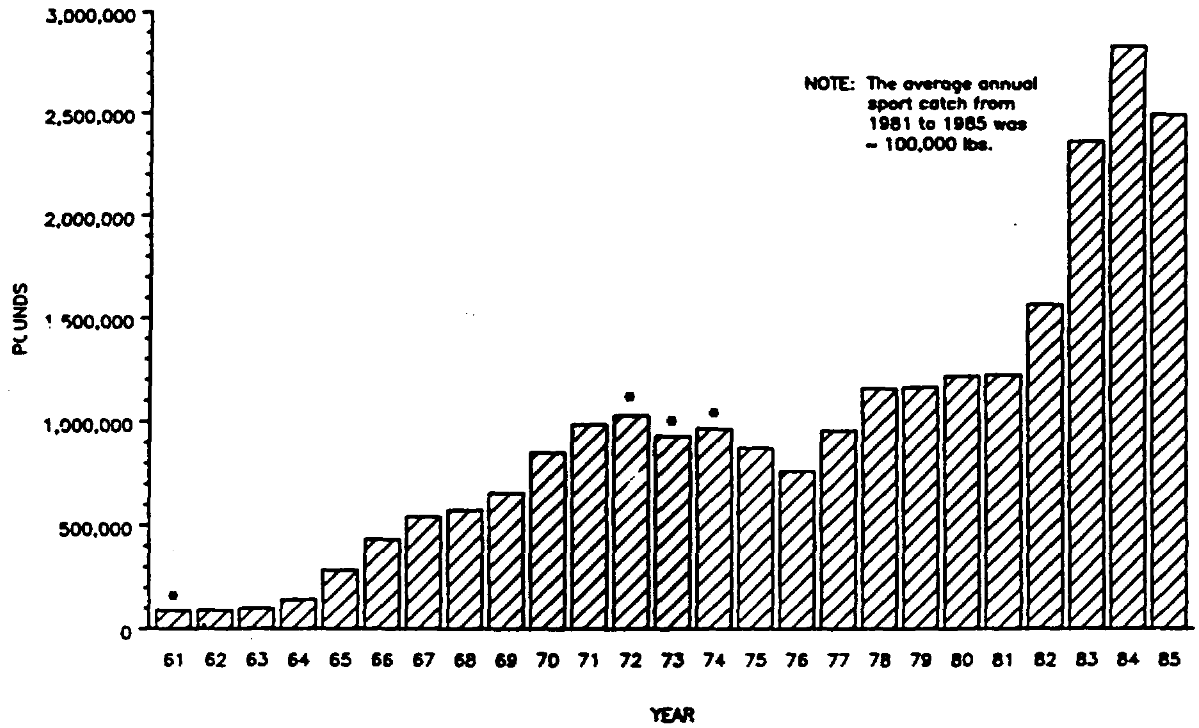
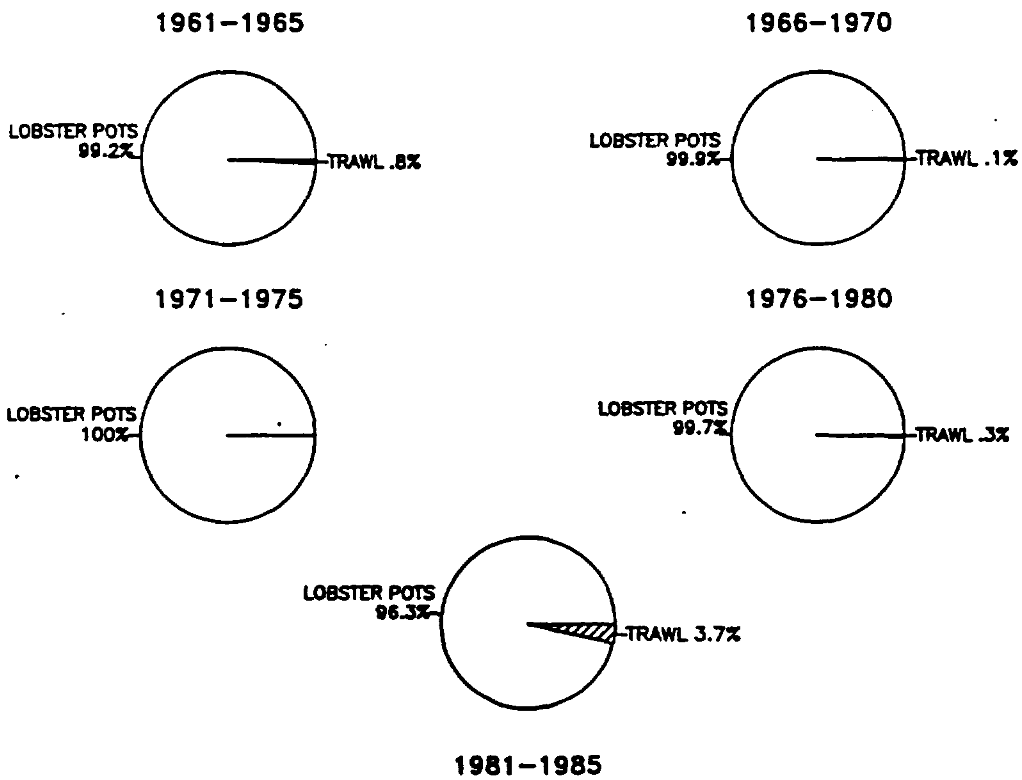
## COMMERCIAL LANDINGS OF LOBSTER TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




## COMMERCIAL LANDINGS BY GEAR TYPE OF LOBSTER TAKEN FROM LONG ISLAND SOUND, 1961 – 1985



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## American oyster
## (Crassostrea virginica)

Over 95% of Long Island Sound oyster harvests were produced by dredge between 1961-1985. The remainder of the landings have resulted from the use of tongs. The lowest landings in the 25-year period were produced during the late 1960's and early 1970's, with increased harvests from the mid-1970's to mid-1980's; the peak harvest occurred in 1984. As with hard clams and conch, landings are reported as "pounds of meats" rather than live weight. Consequently, the harvests reported here substantially underestimate the weight of the resource landed (i. e. with "shell on"). For example, at a ratio of eight lbs. "in the shell" to one pound of meat, the 1985 harvest was actually 8.8 million lbs.

Unlike naturally-occurring resources such as finfish and lobsters, most oyster production now results from the aquaculture practices of shellfishermen in Connecticut waters, who harvest seed (juvenile) oysters from inshore, natural spawning beds and transplant them to open waters for maturation. Shellfish may also be relayed from closed areas to open waters to cleanse them of microbial contaminants. A great amount of effort goes into this fishery, not unlike an agricultural effort on land. Predator control and thinning of densities are two practices which can have a significant impact on the magnitude of the harvest. Consequently, the volume of production each year as well as the trend over time should not only be attributed to natural variables influencing year class formation (that is, the strength of the "set") but also to the extent and degree of success of the culture effort expended.

Early in the 25-year period, poor sets of larvae, starfish predation, and a general shortage of seed oysters were the principal factors responsible for the volume of production each year. Since the mid-1970's, improved cultivation (i. e. the planting of clean shell material as larval settling substrate) has been responsible for enhancing the potential of the available resource.

Gear-specific landings from Long Island Sound in 1961 were interpolated as described previously. Interpolations were made for missing New York dredge data in 1972 and 1974.

Recreational catches are not reported in any consistent manner. In both Connecticut and New York, many inshore areas are closed due to unacceptable levels of bacterial contamination and those which are open are frequently managed under individual town jurisdiction; for these reasons, no consistent harvest statistics are available.

COMMERCIAL HARVEST OF OYSTERS TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

GEAR TYPE

| YEAR | OYSTER DREDGE | TONGS | TOTAL HARVEST |
|---|---|---|---|
| 1961 | 487,700* | 4,100* | 491,800* |
| 1962 | 461,100 | 6,000 | 467,100 |
| 1963 | 437,600 | 1,500 | 439,100 |
| 1964 | 207,300 | 800 | 208,100 |
| 1965 | 329,900 | 7,700 | 337,600 |
| 1966 | 410,600 | 7,100 | 417,700 |
| 1967 | 326,600 | 3,000 | 329,600 |
| 1968 | 220,400 | 200 | 220,600 |
| 1969 | 133,100 | 400 | 133,500 |
| 1970 | 222,200 | 200 | 222,400 |
| 1971 | 274,300 | 100 | 274,400 |
| 1972 | 160,500* | 100 | 160,600* |
| 1973 | 153,900 | | 153,900 |
| 1974 | 716,900* | 100 | 717,000* |
| 1975 | 995,900 | | 995,900 |
| 1976 | 477,400 | 200 | 477,600 |
| 1977 | 1,145,700 | 300 | 1,146,000 |
| 1978 | 1,233,700 | 700 | 1,234,400 |
| 1979 | 655,600 | 2,700 | 658,300 |
| 1980 | 1,047,900 | 15,900 | 1,063,800 |
| 1981 | 1,580,600 | 18,200 | 1,598,800 |
| 1982 | 1,676,900 | 43,900 | 1,720,800 |
| 1983 | 1,342,000 | 70,400 | 1,412,400 |
| 1984 | 2,202,100 | 57,300 | 2,259,400 |
| 1985 | 1,064,100 | 41,900 | 1,106,000 |

[1] Harvests reported as pounds of meats
* interpolated values included



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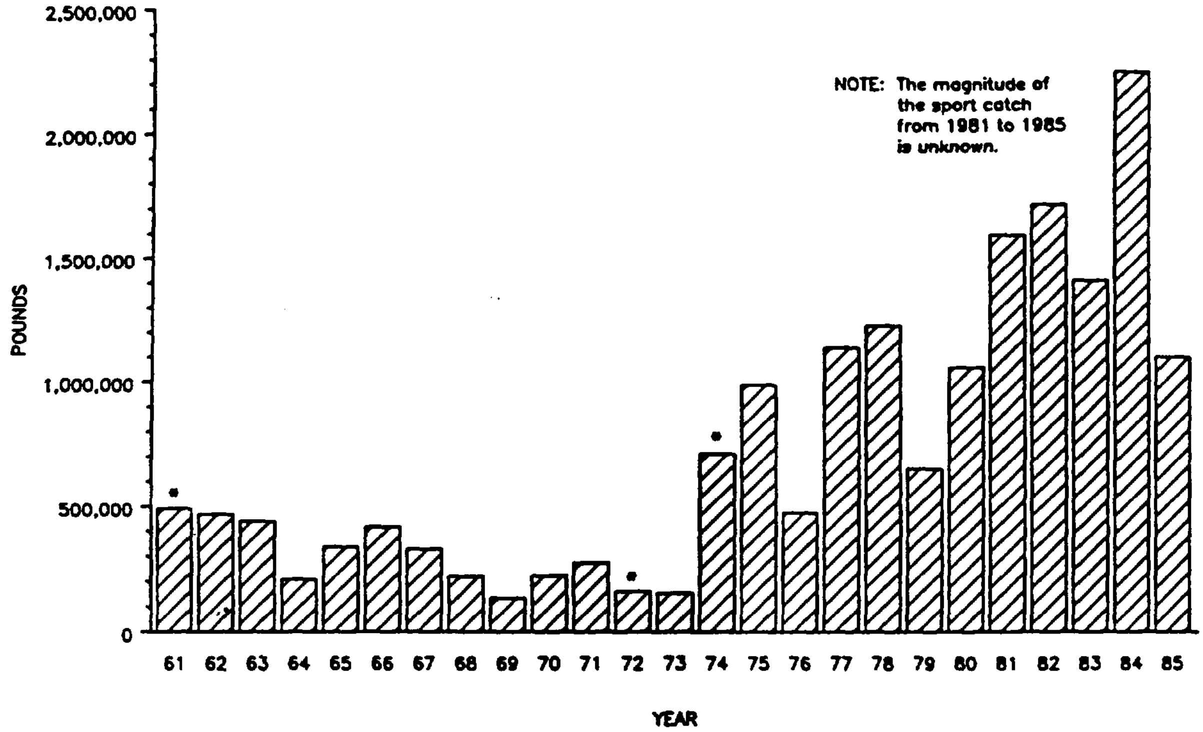
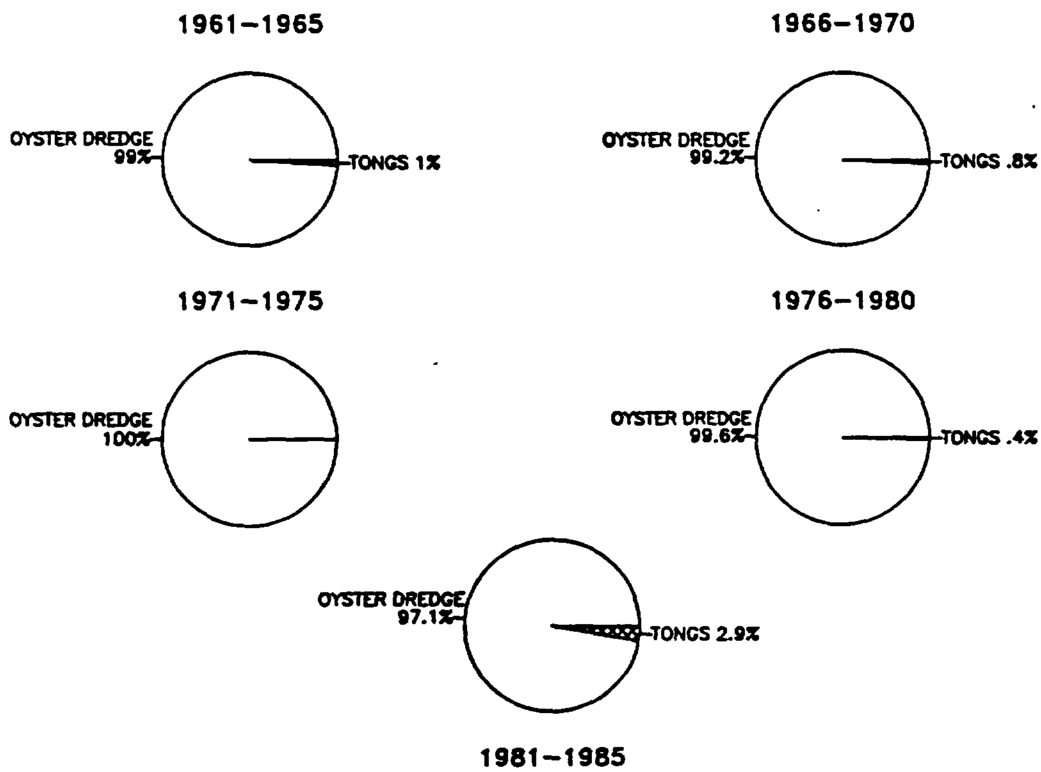
COMMERCIAL LANDINGS OF OYSTERS
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




COMMERCIAL LANDINGS BY GEAR TYPE OF OYSTER
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985



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## Hard clam (Mercenaria mercenaria)

During the period 1961-65, clam dredges accounted for about one-half of Long Island Sound clam harvests, with tongs and rakes contributing the remainder. From the mid-1960's through the mid-1970's, dredges were the predominant gear, with rakes generally second. From 1975-78, dredge landings declined by 50% from the early 1970's, and tong landings almost tripled, resulting in a temporary shift in the gear-specific distribution of landings from the fishery. Since 1979, landings have once again been dominated by dredge harvests. The lowest landings in the 25-year period were produced during the mid-1970's with increased harvests through the 1980's; the greatest landings occurred in the early 1960's. As with oysters and conch, landings are reported as "pounds of meats" rather than live weight. Consequently, the harvests reported here substantially underestimate the weight of the resource landed (i. e. with "shell on"). For example, at a conversion ratio of eight lbs. in the shell to one pound of meat, the 1985 harvest was actually 8.8 million lbs.

In 1961 and again in 1973, two data recording errors appear to have been committed in the designation of public instead of private clam dredge landings for Connecticut (private and public dredge landings are aggregated in this document).

Gear-specific landings from Long Island Sound in 1961 were interpolated as described previously. From 1983-85, New York hard clam landings by gear type are unavailable due to data confidentiality (i. e. fewer than three individual reporting units constituted the gear-specific landings).

Recreational catches are not reported in any consistent manner. Many inshore areas are closed due to unacceptable levels of bacterial contamination, eliminating large areas which might otherwise be utilized for recreational shellfishing. Those areas which are open are frequently managed under town jurisdiction; in such instances, no consistent harvest statistics are available.

COMMERCIAL HARVEST OF HARD CLAMS TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

GEAR TYPE

| YEAR | CLAM DREDGE | TONGS | RAKES | TOTAL HARVEST |
|---|---|---|---|---|
| 1961 | 1,277,700* | 668,000* | 673,700* | 2,619,400* |
| 1962 | 1,289,600 | 816,100 | 806,400 | 2,912,100 |
| 1963 | 1,256,600 | 796,400 | 784,800 | 2,837,800 |
| 1964 | 915,900 | 352,700 | 373,200 | 1,641,800 |
| 1965 | 436,800 | 270,500 | 289,800 | 997,100 |
| 1966 | 695,400 | 218,900 | 256,700 | 1,171,000 |
| 1967 | 727,000 | 152,900 | 248,800 | 1,128,700 |
| 1968 | 449,800 | 93,600 | 151,800 | 695,200 |
| 1969 | 307,200 | 85,400 | 148,700 | 541,300 |
| 1970 | 373,400 | 76,100 | 135,000 | 584,500 |
| 1971 | 471,300 | 74,600 | 127,800 | 673,700 |
| 1972 | 519,000 | 56,500 | 101,300 | 676,800 |
| 1973 | 247,400 | 65,300 | 14,800 | 327,500 |
| 1974 | 306,200 | 58,600 | 36,800 | 401,600 |
| 1975 | 196,600 | 200,500 | 117,000 | 514,100 |
| 1976 | 189,400 | 158,100 | 97,800 | 445,300 |
| 1977 | 218,300 | 131,800 | 51,500 | 401,600 |
| 1978 | 222,300 | 164,500 | 63,400 | 450,200 |
| 1979 | 376,100 | 90,000 | 89,500 | 555,600 |
| 1980 | 414,200 | 103,700 | 73,900 | 591,800 |
| 1981 | 458,500 | 119,100 | 236,400 | 814,000 |
| 1982 | 547,900 | 132,800 | 171,700 | 852,400 |
| 1983 | 461,600[2]+ | + | + | 820,300[3] |
| 1984 | 771,600[2]+ | + | + | 1,071,000[3] |
| 1985 | 884,900[2]+ | + | + | 1,093,600[3] |

[1] Harvests reported as pounds of meats
[2] Values are for Connecticut clam dredge data only
+ NY gear-specific data confidential for 1983-1985
[3] New York gear-specific data included in totals
* Interpolated values included



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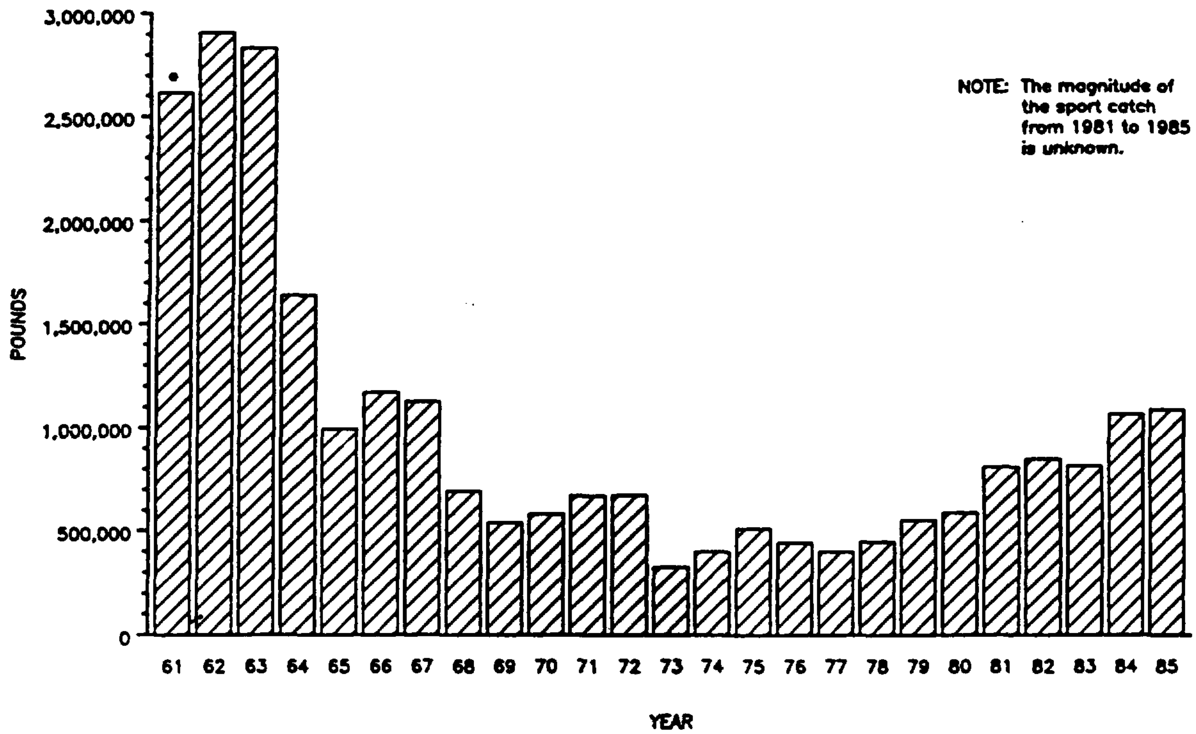
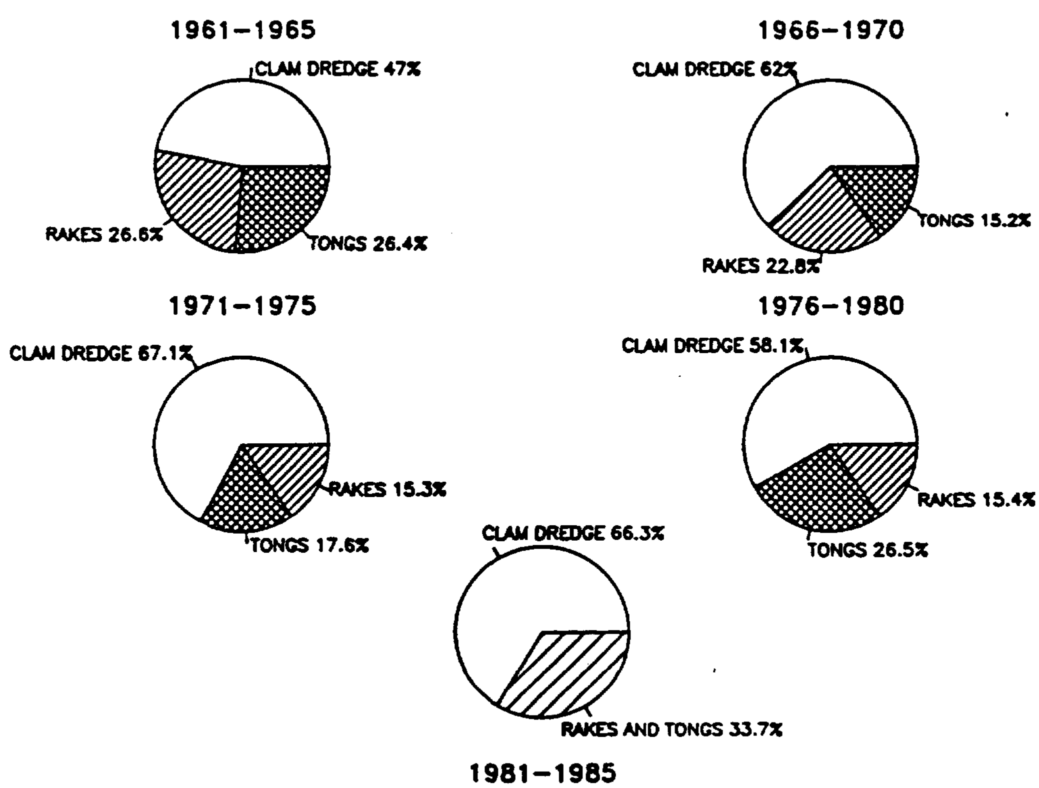
## COMMERCIAL LANDINGS OF HARD CLAMS TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




## COMMERCIAL LANDINGS BY GEAR TYPE FOR HARD CLAMS TAKEN FROM LONG ISLAND SOUND, 1961 – 1985



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## Conch (channeled whelk) (Busycon canaliculatum)

Conch pots have been the major gear to produce landings throughout the 25-year period. During 1961-66 and again from 1977-1985, trawl nets were the second most important gear. Lobster pot landings were reported from 1967-1975 and represented the second most important gear from 1967 through 1974. Tongs, rakes, and dredges produced low and inconsistent landings, principally from the mid-1960's to the mid-1970's. Conch pot landings rose throughout the 1960's, peaking in 1971 before declining to one of the lowest levels on record in 1976. From 1977 through 1981, conch pot landings rose rapidly to a peak of 474,700 lbs., reported (as are all molluscan shellfish except squid) as "pounds of meats." Landings have since declined again to a level approximately one quarter those made in 1981.

Landings by the trawl net fishery declined to zero during the period 1973-76 although the pot fishery continued to produce landings. This observation lends credence to the suggestion that the Long Island Sound trawl net fishery declined in the mid-1970's, a point supported by data presented herein for other species.

Gear-specific landings from Long Island Sound in 1961 were interpolated as described previously. No interpolations of trawl net values for 1973-76 were made since it could not be determined whether the fishery produced any landings at all during the four year period.

Recreational catches of conch are not reported in any consistent manner. Such catches are believed to be quite low.

COMMERCIAL LANDINGS OF CONCH TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

GEAR TYPE

| YEAR | OTTER TRAWL | CONCH POTS | LOBSTER POTS | DREDGES, RAKES, TONGS | TOTAL LANDINGS |
|---|---|---|---|---|---|
| 1961 | 2,400* | 62,400* | | | 64,800* |
| 1962 | 11,200 | 75,000 | | | 86,200 |
| 1963 | 4,500 | 77,100 | | | 81,600 |
| 1964 | 5,100 | 62,000 | | | 67,100 |
| 1965 | 700 | 60,000 | | | 60,700 |
| 1966 | 1,400 | 128,400 | | | 129,800 |
| 1967 | 400 | 95,400 | 11,600 | 1,600 | 109,000 |
| 1968 | 1,100 | 32,300 | 9,900 | 500 | 43,800 |
| 1969 | 1,700 | 105,100 | 14,200 | 800 | 121,800 |
| 1970 | 6,000 | 154,800 | 17,800 | 1,300 | 179,900 |
| 1971 | 700 | 200,800 | 12,400 | 11,900 | 225,800 |
| 1972 | 400 | 197,600 | 10,200 | 4,800 | 213,000 |
| 1973 | | 132,400 | 2,500 | | 134,900 |
| 1974 | | 131,000 | 4,400 | 200 | 135,600 |
| 1975 | | 108,400 | 500 | 800 | 109,700 |
| 1976 | | 47,800 | | 1,000 | 48,800 |
| 1977 | 3,900 | 53,200 | | | 57,100 |
| 1978 | 700 | 88,000 | | 300 | 89,000 |
| 1979 | 4,800 | 164,800 | | | 169,600 |
| 1980 | 5,300 | 153,800 | | | 159,100 |
| 1981 | 5,000 | 474,700 | | | 479,700 |
| 1982 | 1,500 | 134,900 | | | 136,400 |
| 1983 | 2,900 | 205,600 | | 200 | 208,700 |
| 1984 | 7,200 | 206,700 | | 1,300 | 215,200 |
| 1985 | 8,200 | 109,400 | | 1,700 | 119,300 |

[1] Landings reported as pounds of meats

* Interpolated values included



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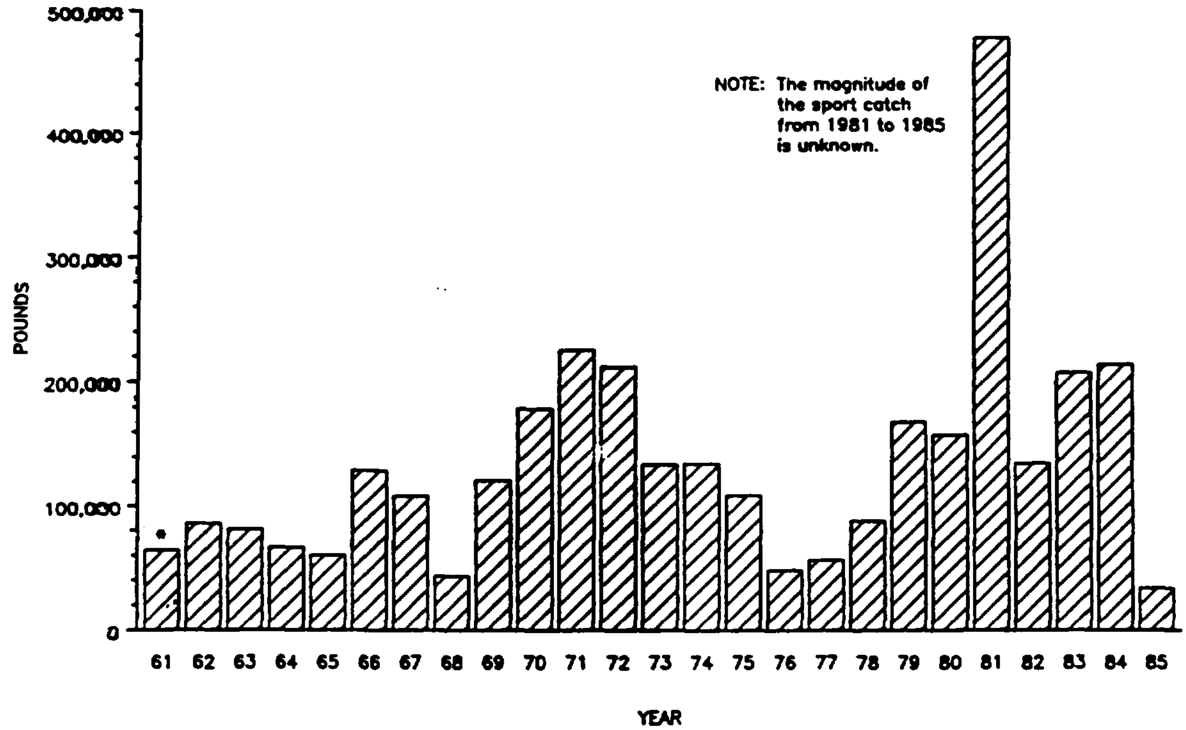
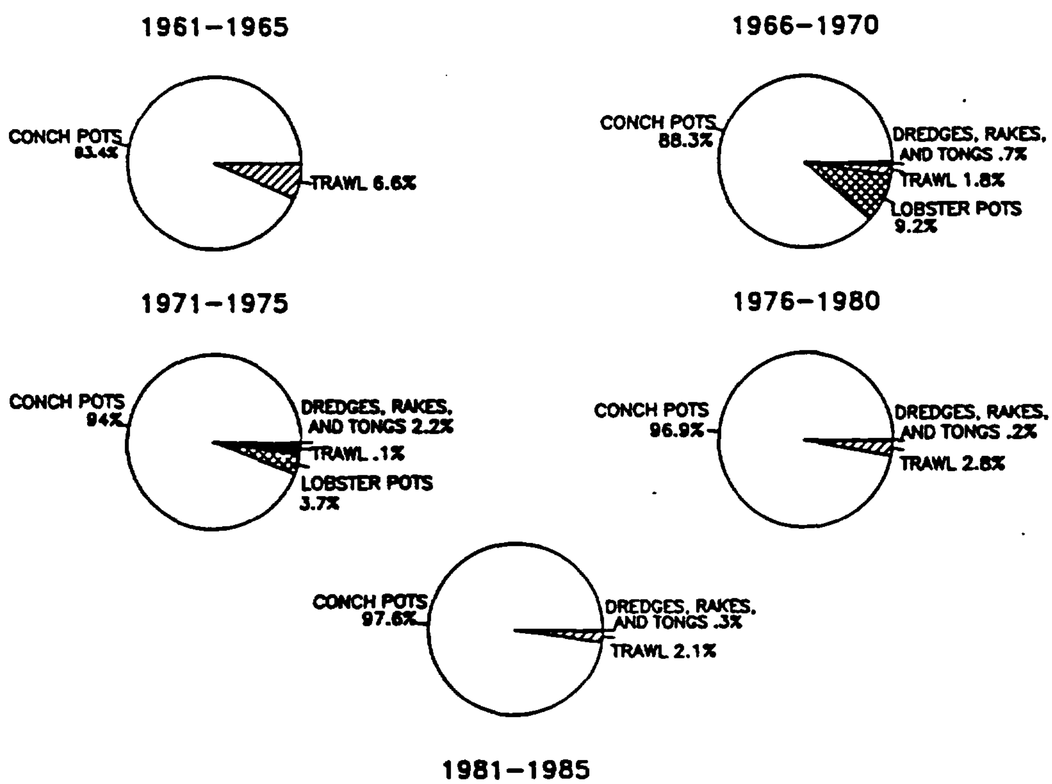
## COMMERCIAL LANDINGS OF CONCH TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




## COMMERCIAL LANDINGS BY GEAR TYPE OF CONCH TAKEN FROM LONG ISLAND SOUND, 1961 – 1985



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## Squid (long-finned squid) (*Loligo pealii*)

Two species of squid constitute the resource fished for in New England and Mid-Atlantic waters. The long-finned squid predominates in Long Island Sound, with short-finned squid (*Illex* sp.) of little significance in inshore waters. For this reason, the landings reported here have been identified as long-finned squid.

The otter trawl and pound net were the two principal gear types used to take squid from Long Island Sound during the 25-year period. Trawl fishery landings of squid from the Sound, as reported by both Connecticut and New York, declined to virtually nothing during the period 1970-75, increasing once again in the late 1970's through the mid-1980's. Pound net landings remained stable throughout the period. Peak trawl fishery landings occurred in 1983 and 1985.

Gear-specific landings from Long Island Sound in 1961 were interpolated as described previously. New York trawl net records were absent in 1968 and from 1970-75; a value for 1968 was interpolated (because of the length of the latter period, interpolations were not made). New York pound net landings were interpolated from 1972-75. Connecticut trawl net records were missing for 1972-73 and 1975-76; these values were interpolated from 1968-1971 and 1974 records, and 1974 and 1977-1979 records, respectively.

No recreational catches of squid are reported by NMFS, however, it is known that they are taken inshore in small numbers during springtime. Commercial landings undoubtedly far exceed sport catches.

COMMERCIAL LANDINGS OF SQUID TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

| | GEAR TYPE | | | |
|---|---|---|---|---|
| YEAR | OTTER TRAWL | POUND NET | OTHER | TOTAL LANDINGS |
| 1961 | 71,600* | | | 71,600* |
| 1962 | 125,000 | | | 125,000 |
| 1963 | 43,500 | | | 43,500 |
| 1964 | 49,400 | | | 49,400 |
| 1965 | 24,500 | | | 24,500 |
| 1966 | 26,600 | 2,300 | | 28,900 |
| 1967 | 28,400 | 50,400 | | 78,800 |
| 1968 | 18,800* | 69,400 | 1,000 | 89,200* |
| 1969 | 17,600 | 11,700 | | 29,300 |
| 1970 | 400 | 6,400 | | 6,800 |
| 1971 | 100 | 38,500 | | 38,600 |
| 1972 | 200* | 28,700* | | 28,900* |
| 1973 | 600* | 10,600* | | 11,200* |
| 1974 | 1,100 | 27,100* | | 28,200* |
| 1975 | 2,400* | 19,100* | | 21,500* |
| 1976 | 25,500* | 33,400 | | 58,900* |
| 1977 | 28,300 | 900 | | 29,200 |
| 1978 | 27,300 | 11,100 | | 38,400 |
| 1979 | 34,500 | 21,900 | | 56,400 |
| 1980 | 80,500 | 28,300 | 100 | 108,900 |
| 1981 | 42,900 | 12,600 | 1,000 | 56,500 |
| 1982 | 37,600 | 7,900 | | 45,500 |
| 1983 | 191,600 | 55,900 | 100 | 247,600 |
| 1984 | 99,200 | 15,200 | 100 | 114,500 |
| 1985 | 275,700 | 16,400 | | 292,100 |

[1] landings reported in pounds (lbs.)

* interpolated values included



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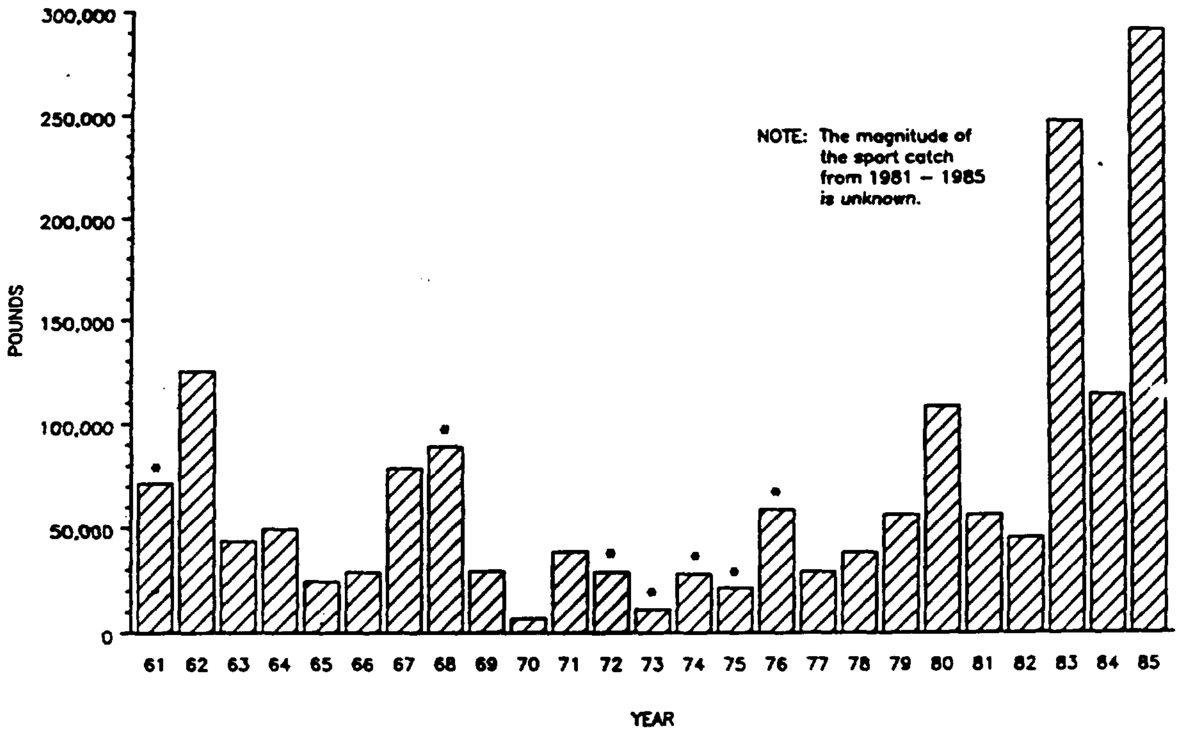
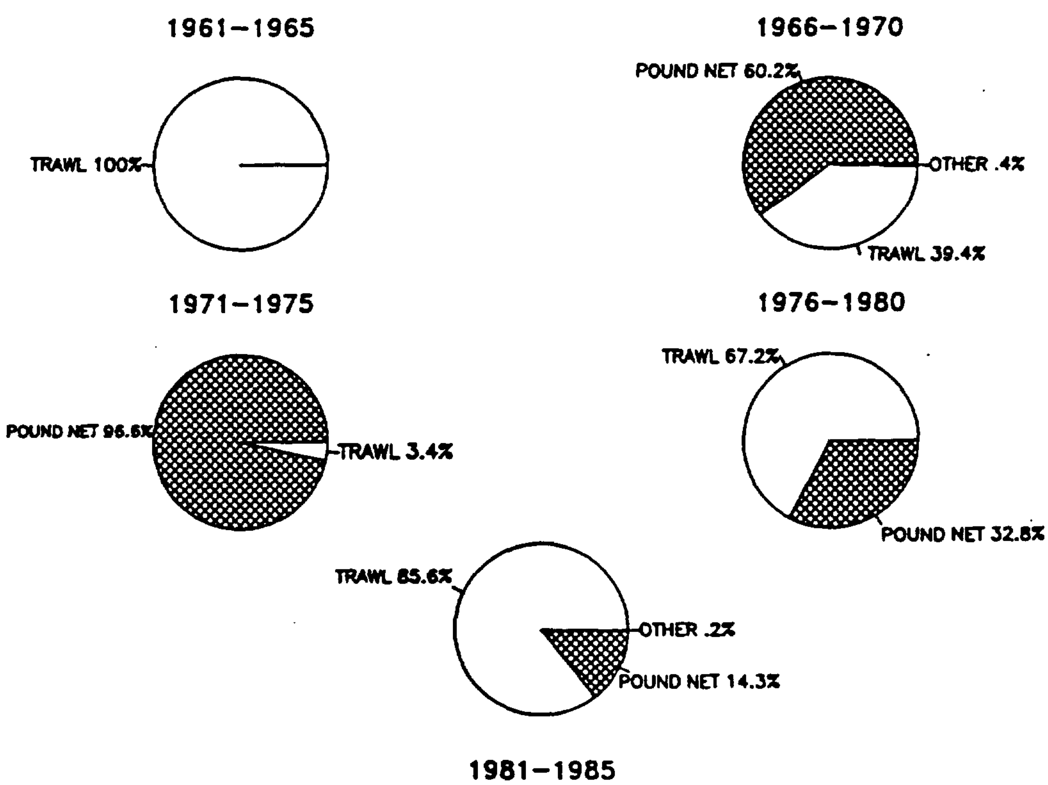
COMMERCIAL LANDINGS OF SQUID
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




COMMERCIAL LANDINGS BY GEAR TYPE OF SQUID
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985






103197

Ref. 2 Y of 45 40

**FINFISH**

Blackfish (Tautoga onitis)
Bluefish (Pomatomus saltatrix)
Butterfish (Peprilus triacanthus)
Mackerel (Scomber scombrus)
Scup (Stenotomus chrysops)
Striped bass (Morone saxatilis)
Summer flounder (Paralichthys dentatus)
Weakfish (Cynoscion regalis)
Winter flounder (Pseudopleuronectes americanus)

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## Blackfish (tautog) (__Tautoga onitis__)

In the early 1960's, the otter trawl was the predominant gear used to take blackfish, followed by hand lines. From 1967 to 1977, pound nets or hand lines were the predominant gears. From 1978-1985, trawl nets again became the dominant gear type, followed by hand lines.

Landings of blackfish taken from Long Island Sound were stable and low until the 1980's when landings of 60,000-95,000 lbs. were reported. This level of landings is far below that of the sport fishery (see below). Little is known about the historical magnitude of the commercial fishery for blackfish. One anecdotal report from a commercial fisherman on Long Island suggests that the resource was abundant in the 1960's and blackfish were taken frequently, however, they often were not retained due to lack of a sufficient price to warrant marketing them. It is likely that greater demand in the 1980's has resulted in the increased landings.

Gear-specific landings data were not reported by water body for either state until 1962; as with all other species reported in this document, 1961 values were interpolated from 1962-63 data. Connecticut trawl net and hand line landings were missing in 1975 and replacement values were interpolated as described in the "Methods." Connecticut catches specific to Long Island Sound were not reported by NMFS from 1981-85. As with all other finfish species (see "Methods" page 3), values were computed based on a ratio of Long Island Sound to total catches reported in the Connecticut Marine Fisheries Information System.

New York data were missing for trawl nets from 1962-1965 and 1969-1976. Since the duration of these omissions suggests that trawler catches may not have been made, interpolations were not attempted. No hand line landings were reported in New York until 1975. Since the fishery existed each year in Connecticut, we believe it did in New York as well; however, values were not interpolated due to the length of time involved. In the event catches did occur but were not identified, the statistics reported here, both for trawl nets and for hand lines, are underestimated. New York pound net data were missing from 1972-74 and were interpolated.

Reported recreational catches of blackfish exceeded commercial catches by 9-15 times, ranging from about 600,000 lbs. in 1981 to 1.4 million lbs. in 1985 with a peak of 1.5 million lbs. in 1982 (see "Note" in Appendix Four).

COMMERCIAL LANDINGS OF BLACKFISH TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

| | GEAR TYPE | | | | |
|---|---|---|---|---|---|
| YEAR | OTTER TRAWL | HAND LINES | POUND NET | OTHER | TOTAL LANDINGS |
| 1961 | 11,500* | 3,400* | | | 14,900* |
| 1962 | 12,800 | 1,400 | | | 14,200 |
| 1963 | 12,100 | 1,700 | | | 13,800 |
| 1964 | 3,500 | 3,300 | | 100 | 6,900 |
| 1965 | 5,000 | 900 | | | 5,900 |
| 1966 | 14,900 | 3,600 | 11,400 | 200 | 30,100 |
| 1967 | 10,600 | 1,900 | 13,700 | 700 | 26,900 |
| 1968 | 3,100 | 1,500 | 9,100 | 2,000 | 15,700 |
| 1969 | 1,800 | 3,500 | 6,700 | 100 | 12,100 |
| 1970 | 3,900 | 7,100 | 6,200 | 500 | 17,700 |
| 1971 | 2,000 | 6,200 | 8,600 | 700 | 17,500 |
| 1972 | 1,400 | 12,200 | 4,200* | | 17,800* |
| 1973 | 1,200 | 7,200 | 3,900* | | 12,300* |
| 1974 | 800 | 9,700 | 3,700* | 3,200 | 17,400* |
| 1975 | 1,500* | 11,700* | 1,400 | | 14,600* |
| 1976 | 1,600 | 13,300 | 2,400 | 4,500 | 21,800 |
| 1977 | 3,100 | 13,900 | 3,400 | 100 | 20,500 |
| 1978 | 10,500 | 8,300 | 1,900 | 900 | 21,600 |
| 1979 | 15,600 | 6,400 | 100 | 2,100 | 24,200 |
| 1980 | 70,700 | 10,600 | 2,300 | 900 | 84,500 |
| 1981 | 42,800 | 15,000 | 3,500 | 1,600 | 62,900 |
| 1982 | 44,800 | 17,100 | 2,900 | 4,300 | 69,100 |
| 1983 | 69,400 | 6,900 | 2,500 | 2,800 | 81,600 |
| 1984 | 44,300 | 12,100 | 6,100 | 15,500 | 78,000 |
| 1985 | 68,100 | 13,400 | 4,100 | 9,200 | 94,800 |

[1] landings reported in pounds (lbs.)

* interpolated values included



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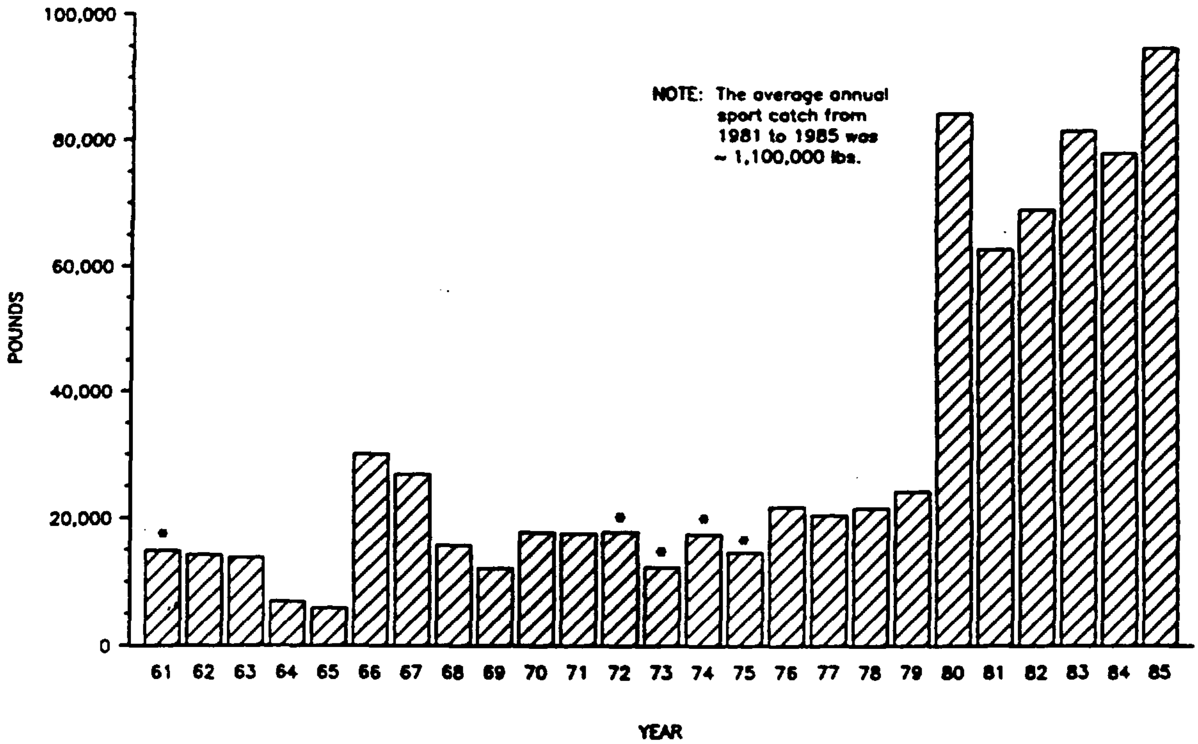
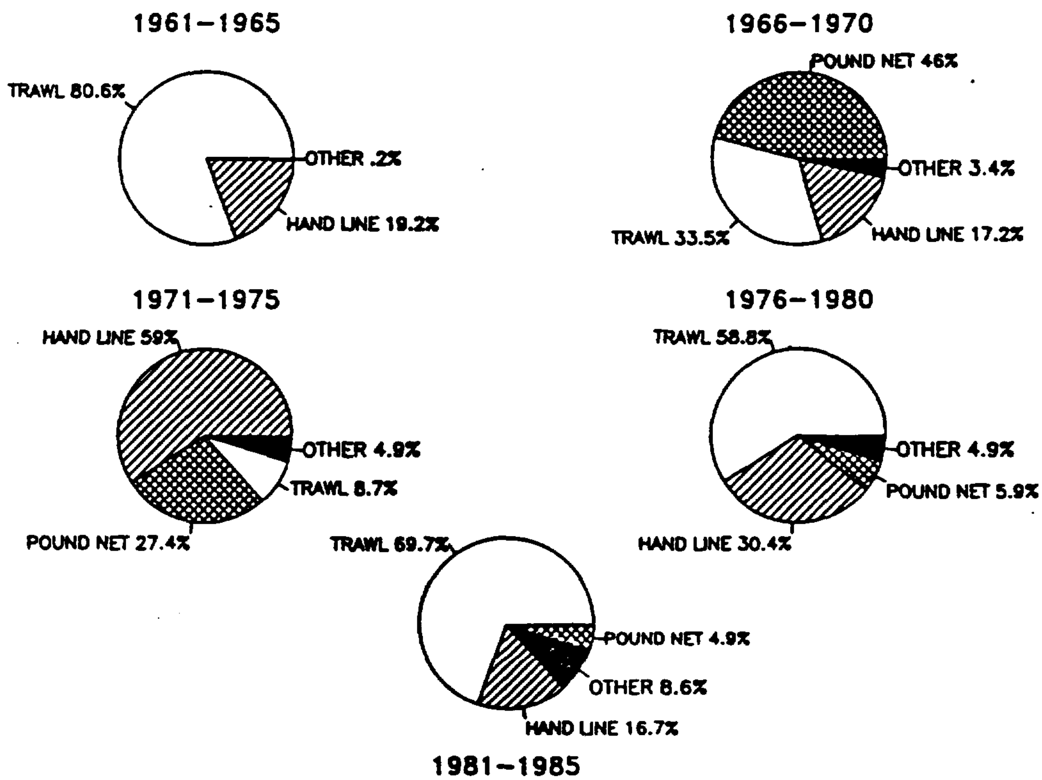
## COMMERCIAL LANDINGS OF BLACKFISH TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




## COMMERCIAL LANDINGS BY GEAR TYPE OF BLACKFISH TAKEN FROM LONG ISLAND SOUND, 1961 – 1985



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## Bluefish (Pomatomus saltatrix)

The bluefish has been among the top four finfish landed in the commercial fishery of Long Island Sound during the period 1961-1985. It is the principal species supporting the sport fishery. In the 1960's, hand lines, gill nets, and pound nets were the predominant commercial gears used to take bluefish; after 1970, gill nets contributed only small amounts. In the mid-1970's, there was a decline in trawl net, pound net, and hand line catches with hand line and trawl net catches increasing through the early 1980's.

Total landings of bluefish from the Sound have been variable since 1969 with annual landings of about 200,000-275,000 lbs. except for two lower periods in 1971-72 and 1975-77 and two peaks in 1980-81 and again in 1985. The growth of the fishery in Long Island Sound in the 1960's appeared to follow the trend observed in the Mid-Atlantic region with operators in other fisheries switching to bluefish towards the end of the decade due to an abundance of bluefish and lack of availability of more traditional species. Since the summer of 1970, New York State has prohibited gillnetting for bluefish in western Long Island Sound, which resulted in a sharp decline in landings in this fishery.

Gear-specific landings from Long Island Sound in 1961 were interpolated as described previously. Data were missing for Connecticut in 1975 for trawl nets, and 1967-68 and 1975 for gill nets; values were interpolated. In New York, no pound net data were reported until 1966 and gill net landings were reported for only five years during the mid-1960's. Since we are uncertain about the extent of the fisheries with these gear types, interpolations were not made. The years 1968, 1970, and 1972-74 were missing for trawl nets. Values for 1968 and 1970 were interpolated from landings recorded in the single years preceding and succeeding the missing value; values for the period 1972-74 were interpolated from the years 1969, 1971 and 1975-77. Pound net and hand line landings from 1972-74 were missing; they were interpolated.

Reported recreational catches of bluefish far exceed those of the commercial fishery, with the sport catch from 1981-85 estimated at 11-21 million lbs. and commercial landings at 200,000-400,000 lbs (see "Note" in Appendix Four).

COMMERCIAL LANDINGS OF BLUEFISH TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

| | GEAR TYPE | | | | |
|---|---|---|---|---|---|
| YEAR | OTTER TRAWL | POUND NET | GILL NET | HAND LINES & OTHER | TOTAL LANDINGS |
| 1961 | 900* | | | 9,500* | 10,400* |
| 1962 | 2,400 | | | 9,300 | 11,700 |
| 1963 | 4,900 | | 25,900 | 6,800 | 37,600 |
| 1964 | 6,800 | | 14,000 | 31,000 | 51,800 |
| 1965 | 15,000 | | 55,100 | 41,900 | 112,000 |
| 1966 | 27,900 | 30,200 | 4,200 | 28,000 | 90,300 |
| 1967 | 6,200 | 18,400 | 8,100* | 58,200 | 90,900* |
| 1968 | 2,400* | 23,400 | 40,500* | 67,200 | 133,500* |
| 1969 | 19,700 | 67,900 | 67,200 | 89,200 | 244,000 |
| 1970 | 31,300* | 123,000 | 16,500 | 105,000 | 275,800* |
| 1971 | 8,100 | 32,700 | 2,500 | 115,800 | 159,100 |
| 1972 | 27,600* | 31,200* | 1,000 | 57,500* | 117,300* |
| 1973 | 53,600* | 62,800* | 1,200 | 127,100* | 244,700* |
| 1974 | 65,600* | 39,800* | 1,200 | 106,900* | 213,500* |
| 1975 | 4,200* | 7,900 | 1,000* | 24,900 | 38,000* |
| 1976 | 22,800 | 8,400 | 5,900 | 21,600 | 58,700 |
| 1977 | 13,300 | 18,400 | 1,500 | 39,300 | 72,500 |
| 1978 | 150,300 | 41,500 | 3,800 | 46,100 | 241,700 |
| 1979 | 102,900 | 39,900 | 5,000 | 53,900 | 201,700 |
| 1980 | 208,200 | 20,600 | 3,000 | 73,900 | 305,700 |
| 1981 | 254,600 | 15,400 | 6,700 | 115,000 | 391,700 |
| 1982 | 78,200 | 23,300 | 7,400 | 94,200 | 203,100 |
| 1983 | 126,500 | 39,200 | 9,300 | 17,400 | 192,400 |
| 1984 | 89,300 | 33,300 | 5,800 | 90,900 | 219,300 |
| 1985 | 148,900 | 63,600 | 13,100 | 119,400 | 345,000 |

[1] landings reported in pounds (lbs.)

* interpolated values included



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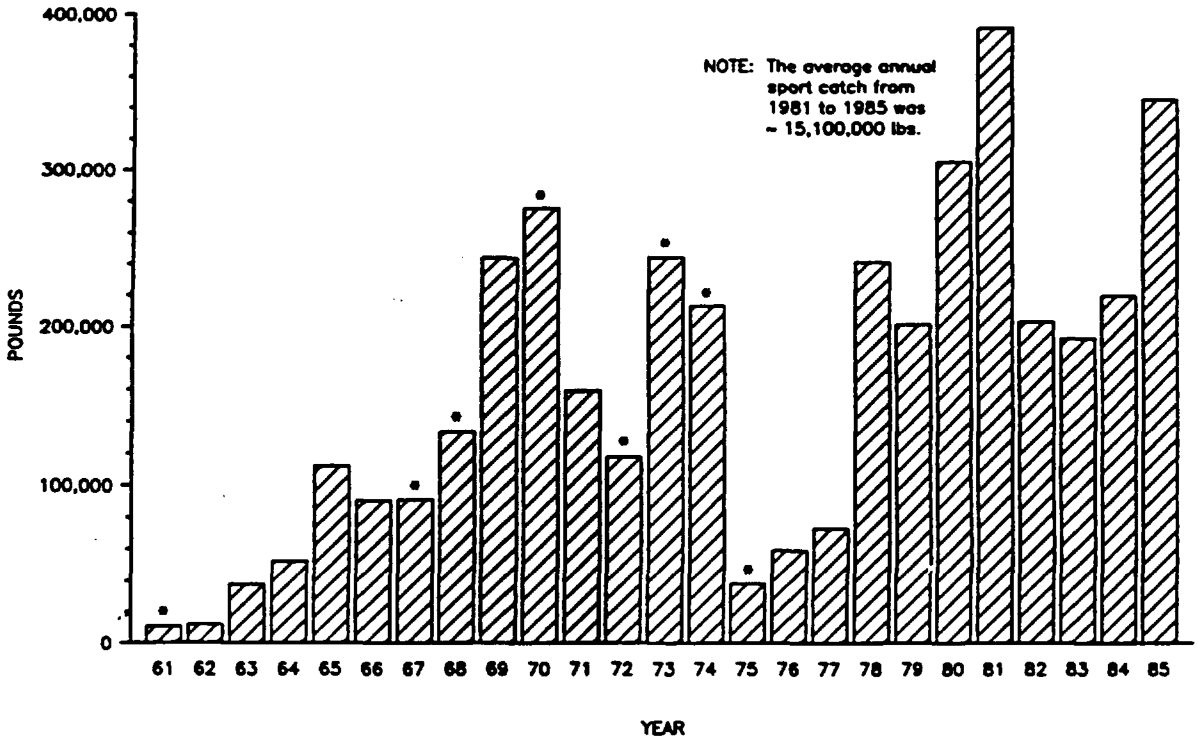
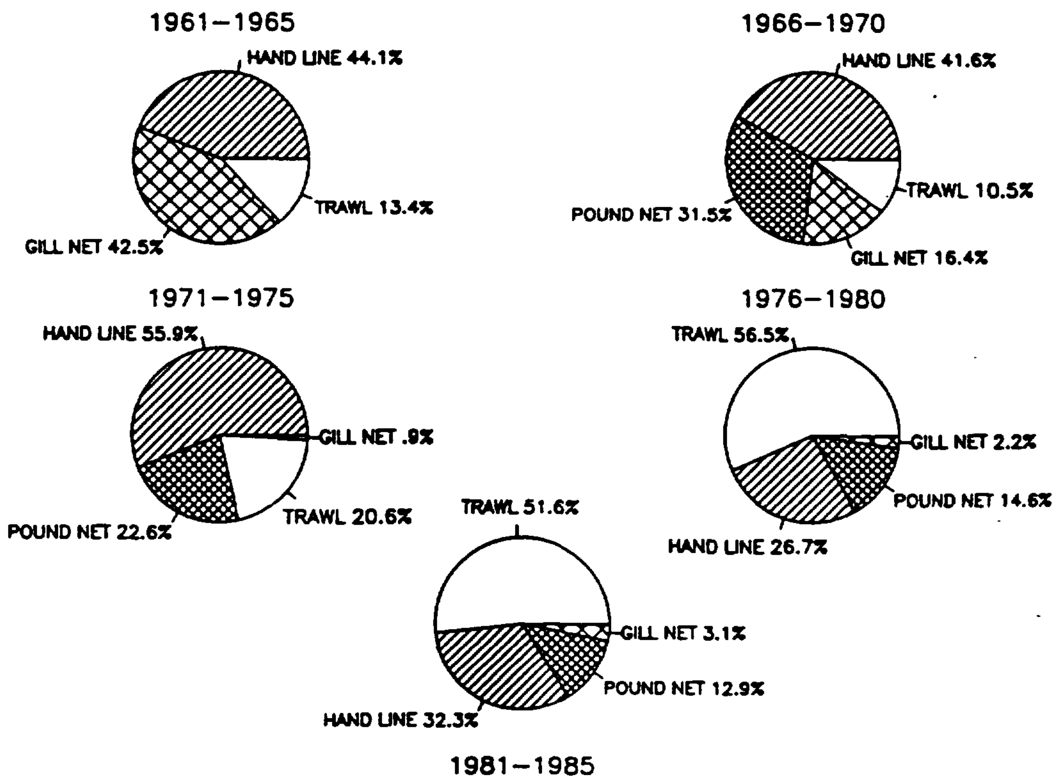
230f45

## COMMERCIAL LANDINGS OF BLUEFISH TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




## COMMERCIAL LANDINGS BY GEAR TYPE OF BLUEFISH TAKEN FROM LONG ISLAND SOUND, 1961–1985



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## Butterfish (Peprilus triacanthus)

The otter trawl and pound net were the two principal gear types used to take butterfish from Long Island Sound during the 25-year period, with pound nets dominating in 1971-72 and 1975. However, very few butterfish were reported from Connecticut from 1972-77, consequently, the apparent dominance of the pound net fishery really only emphasizes the decline of the trawl net fishery during the early 1970's. Gill nets have contributed a small amount to total landings since 1976.

Gear-specific landings from Long Island Sound in 1961 were interpolated as described previously. New York statistics were missing for trawl nets and pound nets during the period 1972-74 and in 1970 for trawl nets; these values were interpolated.

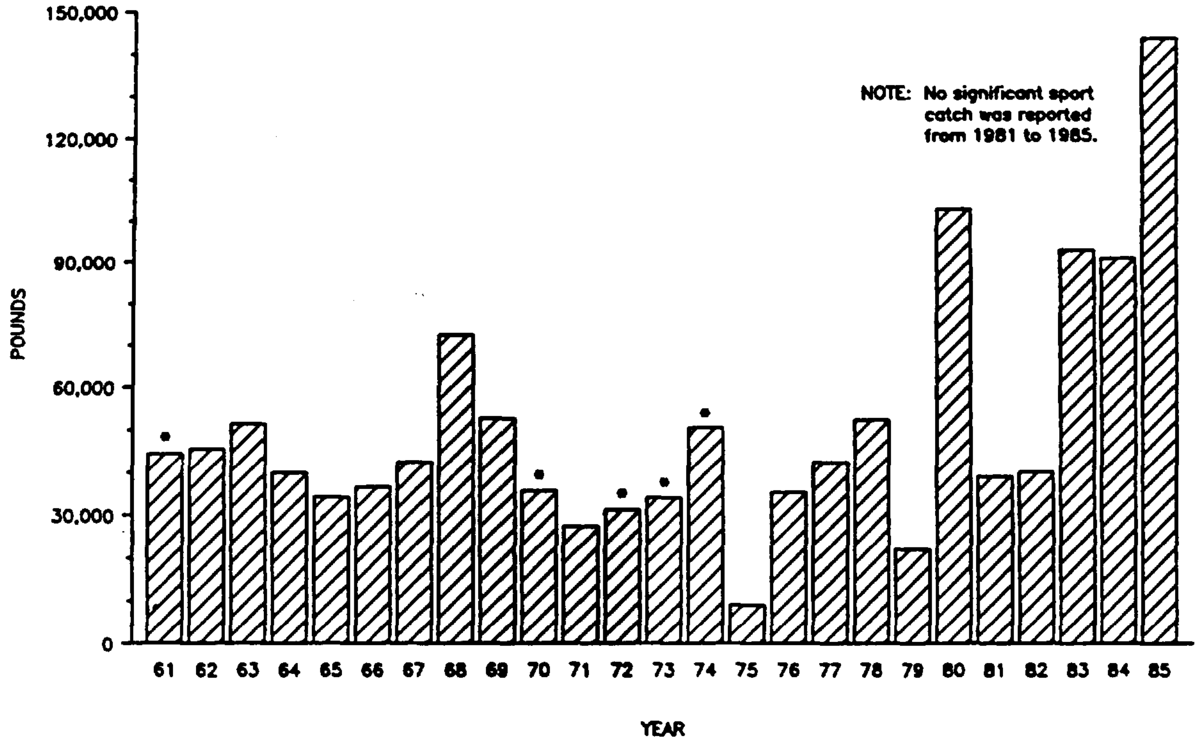
No recreational catches of butterfish are reported by NMFS, and little or no fishery is believed to exist.

COMMERCIAL LANDINGS OF BUTTERFISH TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

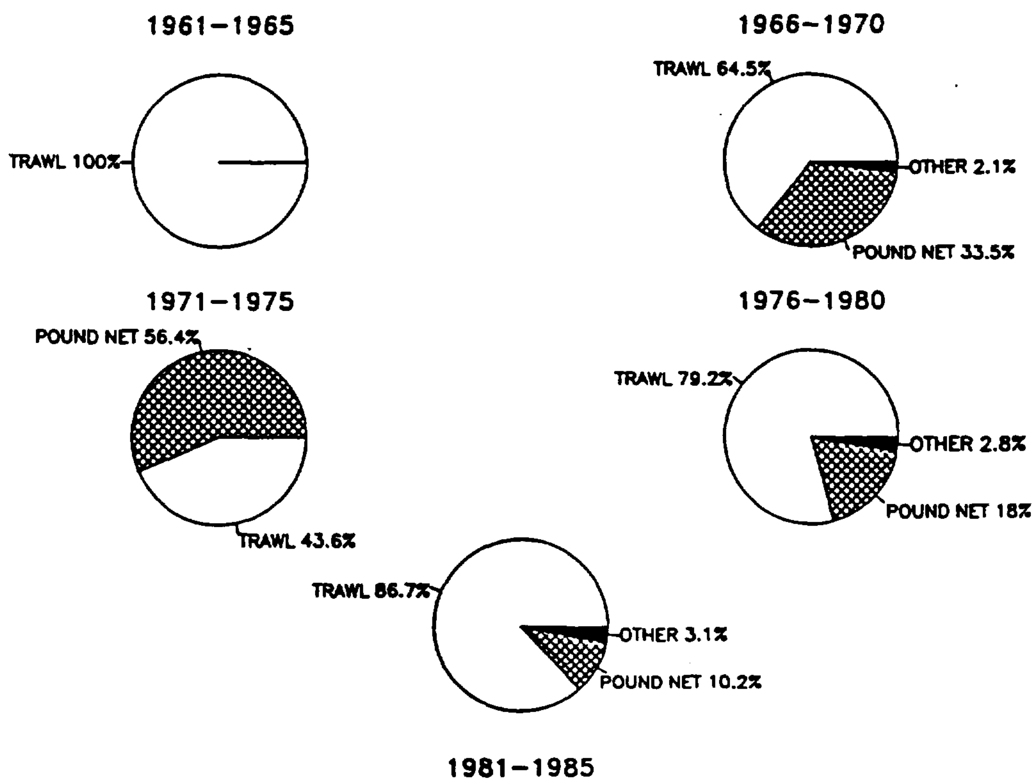
| | GEAR TYPE | | | |
|---|---|---|---|---|
| | OTTER TRAWL | POUND NET | OTHER | TOTAL LANDINGS |
| 1961 | 44,300* | | | 44,300* |
| 1962 | 45,500 | | | 45,500 |
| 1963 | 51,500 | | | 51,500 |
| 1964 | 40,100 | | | 40,100 |
| 1965 | 34,400 | | | 34,400 |
| 1966 | 36,200 | 600 | | 36,800 |
| 1967 | 26,000 | 16,500 | | 42,500 |
| 1968 | 44,300 | 23,600 | 5,000 | 72,900 |
| 1969 | 30,900 | 22,200 | | 53,100 |
| 1970 | 18,100* | 17,800 | | 35,900* |
| 1971 | 9,000 | 18,500 | | 27,500 |
| 1972 | 10,700* | 20,700* | | 31,400* |
| 1973 | 17,900* | 16,400* | | 34,300* |
| 1974 | 27,600* | 23,300* | | 50,900* |
| 1975 | 1,600 | 7,500 | | 9,100 |
| 1976 | 23,800 | 11,400 | 500 | 35,700 |
| 1977 | 33,000 | 9,600 | 100 | 42,700 |
| 1978 | 42,400 | 9,700 | 800 | 52,900 |
| 1979 | 17,300 | 1,500 | 3,500 | 22,300 |
| 1980 | 87,000 | 14,200 | 2,300 | 103,500 |
| 1981 | 27,900 | 8,700 | 2,800 | 39,400 |
| 1982 | 31,700 | 8,000 | 800 | 40,500 |
| 1983 | 80,900 | 10,100 | 2,400 | 93,400 |
| 1984 | 79,200 | 9,300 | 2,800 | 91,300 |
| 1985 | 134,900 | 5,500 | 3,800 | 144,200 |

[1] landings reported in pounds (lbs.)
* interpolated values included

## COMMERCIAL LANDINGS OF BUTTERFISH TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




## COMMERCIAL CATCH BY GEAR TYPE OF BUTTERFISH TAKEN FROM LONG ISLAND SOUND, 1961 – 1985



Ref.
3 of 45

## Mackerel (Scomber scombrus)

The Atlantic mackerel fishery is not of comparable significance to the other commercial and sport fisheries described in this document. The only species mackerel surpassed in total commercial fishery landings from 1961-1985 was the blackfish; reported recreational landings were comparable to those for striped bass and weakfish. The significance of mackerel is that while landings of almost all other species of finfish appeared to decline in the early 1970's, commercial mackerel landings increased, similar to those of other pelagic species (e. g. bluefish, weakfish, striped bass). During the same period, landings of demersal or "bottom" species appear to have reached a low point (e. g. winter flounder, summer flounder, and scup). The significance of these observations as well as the reasons for the differences are unknown.

Pound nets and hand lines were the principal gears used to take mackerel from the mid-1960's through the mid-1970's. Gill nets and pound nets predominated through the early 1980's.

Gear-specific landings from Long Island Sound in 1961 were interpolated as described previously. No Connecticut landings were reported from Long Island Sound in 1963; a value was interpolated as described previously. No mackerel landings by any gear were made in Connecticut in 1975 so interpolations were not made. No New York landings from the Sound were reported until 1966; given the length of time and the low landings reported in Connecticut, interpolations of New York values were not made. Long Island Sound catches by gear type were not available for New York from 1972-74; these values were interpolated.

Reported recreational catches of mackerel, which are highly variable, suggest that the magnitude of the sport fishery in the early 1980's was about five times greater than the commercial fishery, with commercial catches averaging 46,000 lbs. and sport catches averaging 250,000 lbs. (see "Note" in Appendix Four).

COMMERCIAL LANDINGS OF MACKEREL TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

GEAR TYPE

| YEAR | OTTER TRAWL | HAND LINES | POUND NET | GILL NETS | OTHER | TOTAL LANDINGS |
|---|---|---|---|---|---|---|
| 1961 | 3,500* | 5,900* | | 3,600* | | 13,000* |
| 1962 | 1,100 | | | | 2,200 | 3,300 |
| 1963 | 100* | 100* | | | | 200* |
| 1964 | 100 | 300 | | 2,100 | | 2,500 |
| 1965 | | 100 | | 3,500 | | 3,600 |
| 1966 | | 1,600 | 2,400 | 2,000 | | 6,000 |
| 1967 | 2,000 | 4,800 | 17,700 | 200 | | 24,700 |
| 1968 | | 9,700 | 20,700 | | 600 | 31,000 |
| 1969 | 3,200 | 11,800 | 64,100 | 500 | | 79,600 |
| 1970 | 300 | 13,300 | 35,300 | 1,500 | 200 | 50,600 |
| 1971 | | 9,400 | 62,900 | 300 | | 72,600 |
| 1972 | | 8,100* | 54,600* | | | 62,700* |
| 1973 | | 22,100* | 16,800* | | | 38,900* |
| 1974 | | 21,700* | 22,400* | 1,400* | 3,500* | 49,000* |
| 1975 | | 800 | | | | 800 |
| 1976 | | 4,400 | 13,900 | 11,800 | | 30,100 |
| 1977 | 700 | 8,500 | 22,400 | 30,000 | | 61,600 |
| 1978 | 300 | 6,100 | 29,700 | 12,400 | 900 | 49,400 |
| 1979 | 2,000 | 7,500 | 21,900 | 7,900 | | 39,300 |
| 1980 | 1,800 | 12,300 | 21,500 | 23,500 | 2,000 | 61,100 |
| 1981 | 1,000 | 10,500 | 9,600 | 28,000 | 100 | 49,200 |
| 1982 | 700 | 8,100 | 46,900 | 44,400 | | 100,100 |
| 1983 | 1,500 | 1,200 | 19,600 | 12,400 | | 34,700 |
| 1984 | 4,000 | 9,800 | 13,200 | 7,900 | | 34,900 |
| 1985 | 300 | 9,300 | | | | 9,600 |

[1] landings reported in pounds (lbs.)

* interpolated values included

Ref. 40
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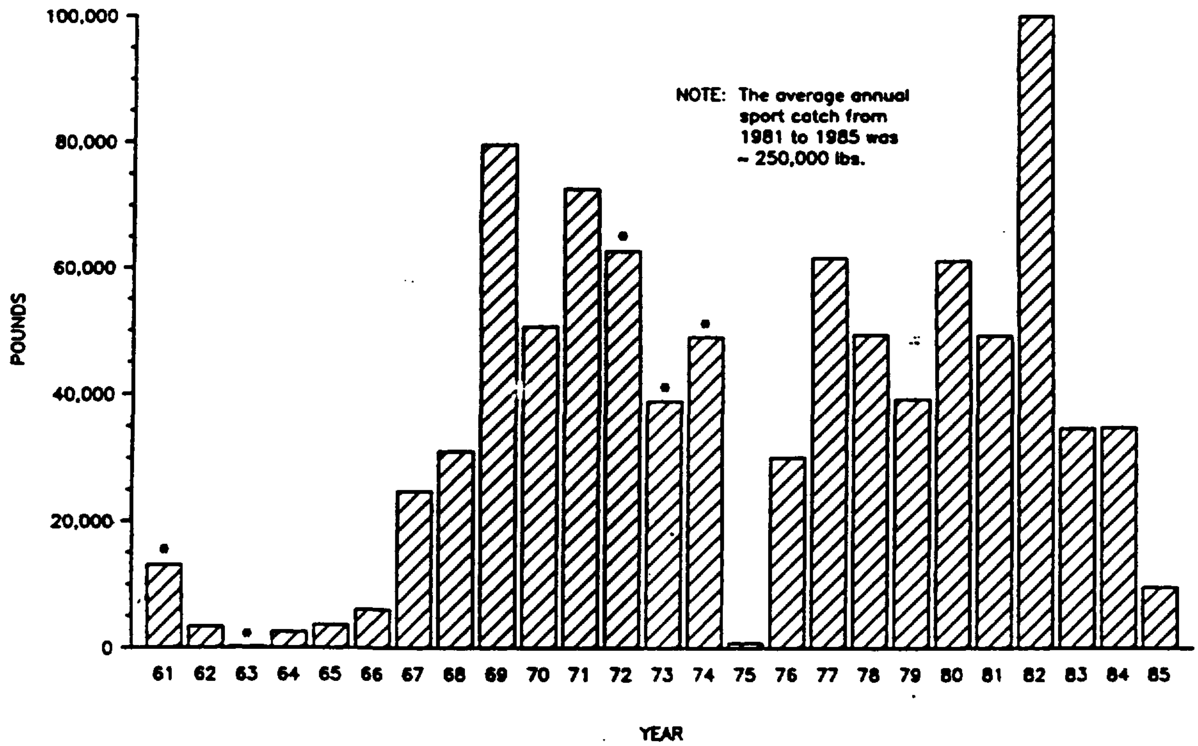
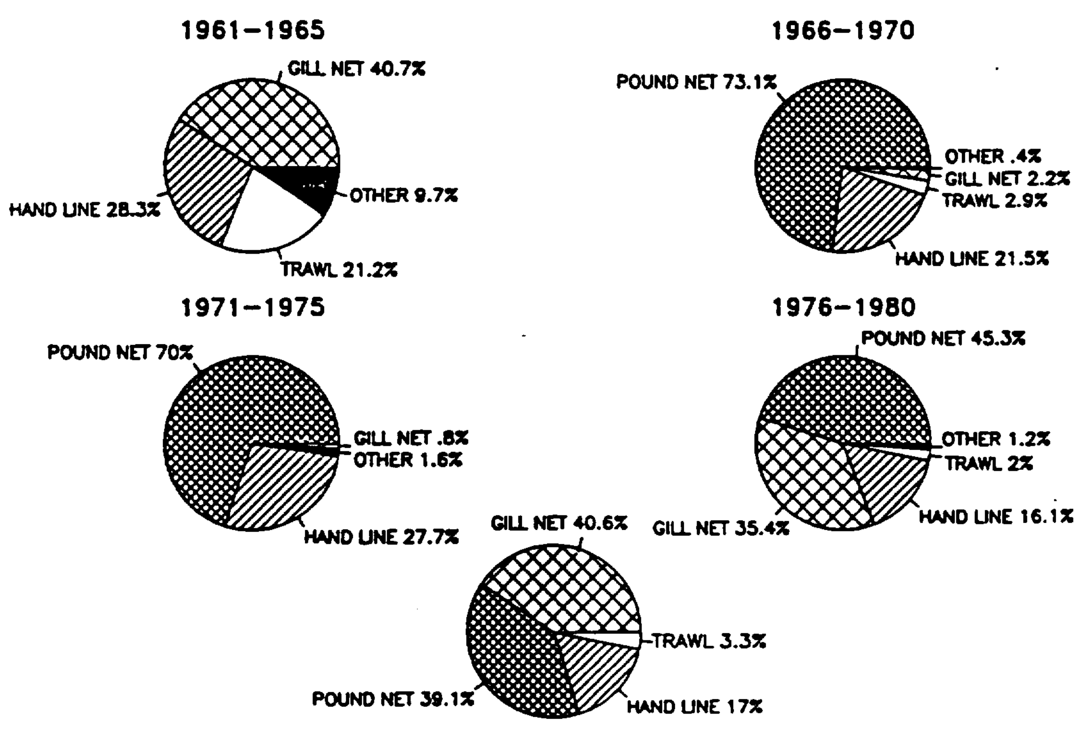
COMMERCIAL LANDINGS OF MACKEREL
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




COMMERCIAL LANDINGS BY GEAR TYPE OF MACKEREL
TAKEN FROM LONG ISLAND SOUND, 1961–1985



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33.f45

## Scup (porgy) (<u>Stenotomus chrysops</u>)

Historically, the scup has been one of the mainstays of the commercial food fishery of Long Island Sound. The otter trawl was used almost exclusively to take scup from the Sound between 1961-1985. Pound net catches reached a maximum in the mid-1970's after which they declined. Hand lines have contributed consistent but small amounts to landings since the early 1970's; prior to 1975, no handline landings from the Sound were reported in New York.

Landings of scup taken from the Sound followed the trend observed in the Mid-Atlantic and New England fisheries. Declines in the late 1960's caused considerable concern, especially in Mid-Atlantic areas. Strong year classes of scup appear to have been produced in 1974 and 1975, supporting the large landings made from 1977-1979.

Gear-specific landings from Long Island Sound in 1961 were interpolated as described previously. Difficulties in data recording occurred in Connecticut, when otter trawl data were missing for the years 1975-1976, and for hand lines in 1975. Due to the large incoming year class of scup in 1978, and the large landings which resulted, use of the observation for this year might have biased the interpolation so it was not used; only the years 1971-1974 and 1977 were used to determine Connecticut otter trawl landings for the years 1975 and 1976. The 1975 hand line value was interpolated as described previously. Otter trawl statistics for New York were missing from 1970, 1972-1974 and 1976; pound net statistics were missing from 1972-1974. Records from 1968, 1969 and 1971 were used to generate a value for 1970; the years 1968, 1969, 1971, 1975 and 1977 were used to generate values for 1972-74, and the 1976 interpolation was derived from the years 1975 and 1977.

Reported recreational catches of scup suggest that the magnitude of the sport fishery in the early 1980's was approximately 2-5 times that of the commercial, with commercial catches varying from 200,000-400,000 lbs. and sport catches from 400,000-1,900,000 lbs. However, in 1985 (and, although not part of the current time series, in 1986 as well) sport catches were reported to exceed commercial catches by 22 times (4.3 million lbs. sport vs. 195,000 lbs. commercial). There seems to be no plausible explanation for this apparent increase (see "Note" in Appendix Four).

COMMERCIAL LANDINGS OF SCUP TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

GEAR TYPE

| YEAR | OTTER TRAWL | HAND LINES | POUND NET | OTHER | TOTAL LANDINGS |
|---|---|---|---|---|---|
| 1961 | 514,800* | 500* | | | 515,300* |
| 1962 | 535,800 | 100 | | | 535,900 |
| 1963 | 546,500 | | | | 546,500 |
| 1964 | 481,600 | 500 | | | 482,100 |
| 1965 | 441,400 | 400 | | | 441,800 |
| 1966 | 329,600 | 300 | 10,800 | | 340,700 |
| 1967 | 101,300 | 200 | 19,200 | | 120,700 |
| 1968 | 99,000 | 500 | 66,300 | | 165,800 |
| 1969 | 76,400 | 300 | 27,000 | 1,300 | 105,000 |
| 1970 | 53,400* | 200 | 12,400 | | 66,000* |
| 1971 | 63,600 | | 7,600 | | 71,200 |
| 1972 | 149,500* | 100 | 16,500* | | 166,100* |
| 1973 | 197,200* | 600 | 88,200* | | 286,000* |
| 1974 | 325,000* | 2,700 | 64,800* | | 392,500* |
| 1975 | 268,000* | 23,100* | 19,300 | | 310,400* |
| 1976 | 410,800* | 3,200 | 31,000 | 1,100 | 446,100* |
| 1977 | 739,100 | 17,100 | 24,700 | 3,000 | 783,900 |
| 1978 | 1,458,300 | 15,300 | 23,500 | 100 | 1,497,200 |
| 1979 | 931,800 | 9,500 | 40,300 | 2,700 | 984,300 |
| 1980 | 467,900 | 12,400 | 15,000 | 500 | 495,800 |
| 1981 | 344,100 | 16,300 | 16,000 | 400 | 376,800 |
| 1982 | 295,300 | 7,400 | 22,500 | 1,600 | 326,800 |
| 1983 | 318,800 | 5,300 | 21,300 | | 345,400 |
| 1984 | 156,200 | 5,800 | 10,100 | | 172,100 |
| 1985 | 172,300 | 16,400 | 6,500 | 100 | 195,300 |

[1] landings reported in pounds (lbs.)

* interpolated values included



103207

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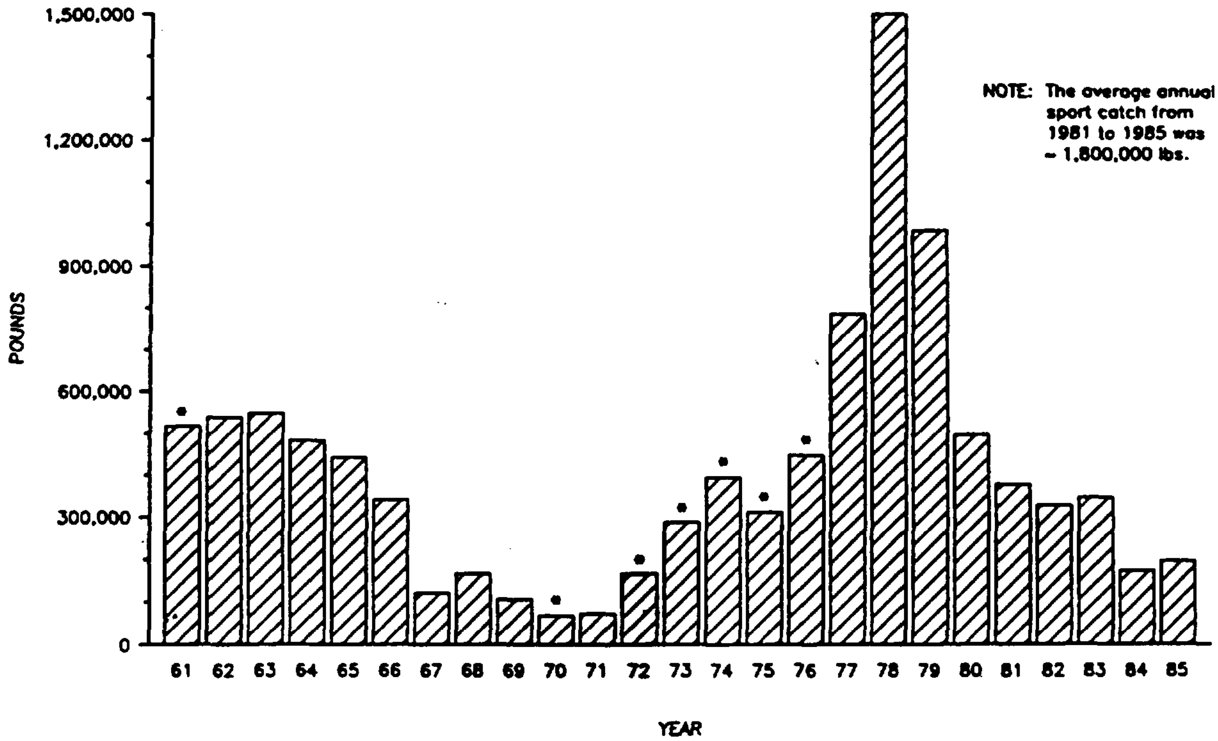
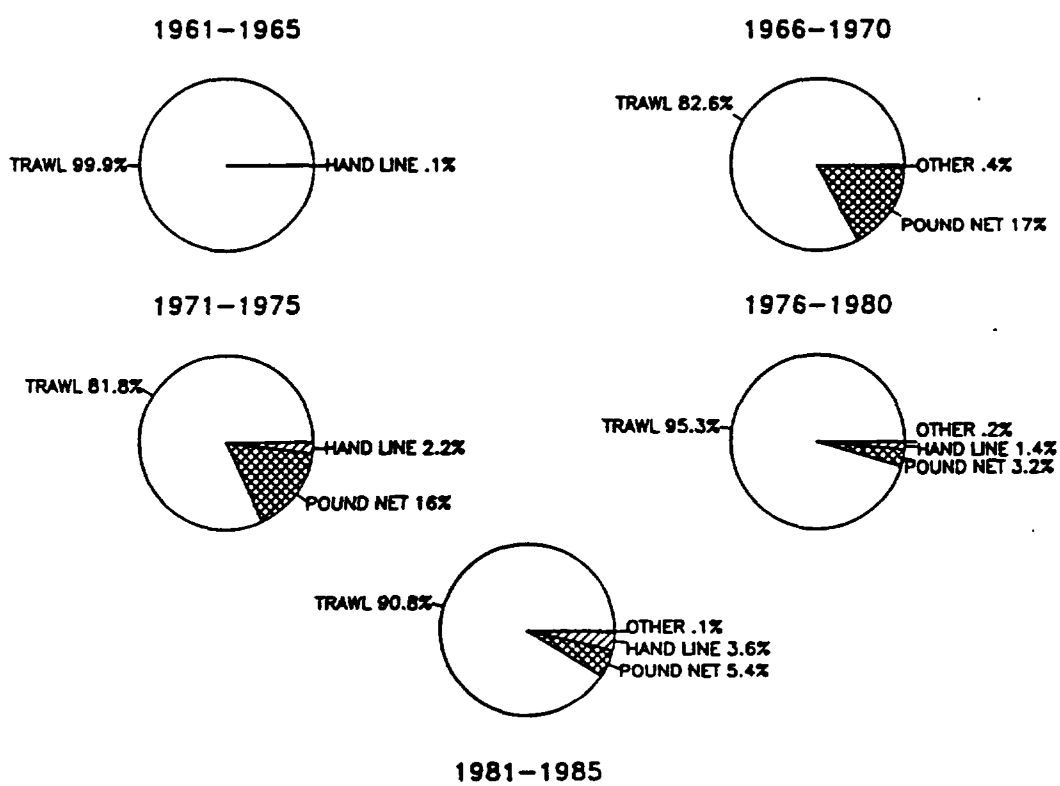
34.f45

COMMERCIAL LANDINGS OF SCUP
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




COMMERCIAL LANDINGS BY GEAR TYPE OF SCUP
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985






103208

Ref 40
35 of 45

## Striped bass (Morone saxatilis)

Since the early 1950's, the sale of striped bass taken from Connecticut waters has been prohibited by State Statute. The sale of striped bass legally taken for commercial purposes from adjoining state waters, and sold in Connecticut, was not prohibited. Because of this fact, Connecticut commercial landings have always been difficult to document and, thus, of questionable quality. Caution in use of these data is recommended.

Hand lines dominated commercial landings from Long Island Sound during the early 1960's, in 1970, and again in the late 1970's; in the late-1960's, early 1970's and early 1980's, pound nets have been the predominant gear. Gill nets produced intermittent and occasionally large landings while trawl net landings have been relatively minor.

Gear-specific landings from Long Island Sound in 1961 were interpolated as described previously. No commercial striped bass landings were reported in Connecticut from 1965-1975. Given the length of this period, interpolation was not attempted. New York pound net and hand line statistics were missing for the period 1972-74. Values for these years were interpolated.

Recreational catches of finfish for Long Island Sound are available through the MRFSS but the estimates lack precision due to insufficient sample sizes (i.e. coefficients of variation are 50% or more). This is particularly true for a species like striped bass. Since it is a nocturnal feeder, it is taken more frequently during night fishing trips and this time of day is not as consistently sampled as the daytime.

For these reasons, the reader is urged to use caution in interpreting the data. Reported recreational landings of Long Island Sound catches appear to be on the order of 100,000-400,000 lbs. per year for fish of an average size of about seven lbs. each (see "Note" in Appendix Four).

COMMERCIAL LANDINGS OF STRIPED BASS TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

| | GEAR TYPE | | | | |
|---|---|---|---|---|---|
| YEAR | OTTER TRAWL | POUND NET | HAND LINE | GILL NET | TOTAL LANDINGS |
| 1961 | | | 15,800* | | 15,800* |
| 1962 | | | 31,700 | 800 | 32,500 |
| 1963 | | | 28,800 | 700 | 29,500 |
| 1964 | | | 29,600 | 5,800 | 35,400 |
| 1965 | | | | 12,600 | 12,600 |
| 1966 | | 52,100 | | | 52,100 |
| 1967 | 7,200 | 60,600 | | 36,800 | 104,600 |
| 1968 | 100 | 55,800 | 3,800 | 21,700 | 81,400 |
| 1969 | | 61,800 | 8,500 | 43,700 | 114,000 |
| 1970 | | 12,600 | 53,000 | 40,200 | 105,800 |
| 1971 | 9,000 | 58,800 | 46,900 | | 114,700 |
| 1972 | | 43,200* | 7,700* | | 50,900* |
| 1973 | | 128,100* | 49,600* | | 177,700* |
| 1974 | | 106,900* | 34,200* | | 141,100* |
| 1975 | 2,000 | 4,300 | 11,100 | | 17,400 |
| 1976 | 2,500 | 3,500 | 69,300 | 800 | 76,100 |
| 1977 | 8,700 | 18,800 | 71,000 | | 98,500 |
| 1978 | 2,000 | 26,100 | 42,700 | | 70,800 |
| 1979 | 3,500 | 10,900 | 54,100 | 2,000 | 70,500 |
| 1980 | | 20,300 | 37,900 | | 58,200 |
| 1981 | | 33,200 | 11,400 | | 44,600 |
| 1982 | 200 | 19,800 | 7,600 | | 27,600 |
| 1983 | 300 | 23,000 | 1,000 | | 24,300 |
| 1984 | 200 | 29,000 | 2,200 | 27,000 | 58,400 |
| 1985 | | 23,200 | 5,500 | | 28,700 |

[1] landings reported in pounds (lbs.)
* interpolated values included



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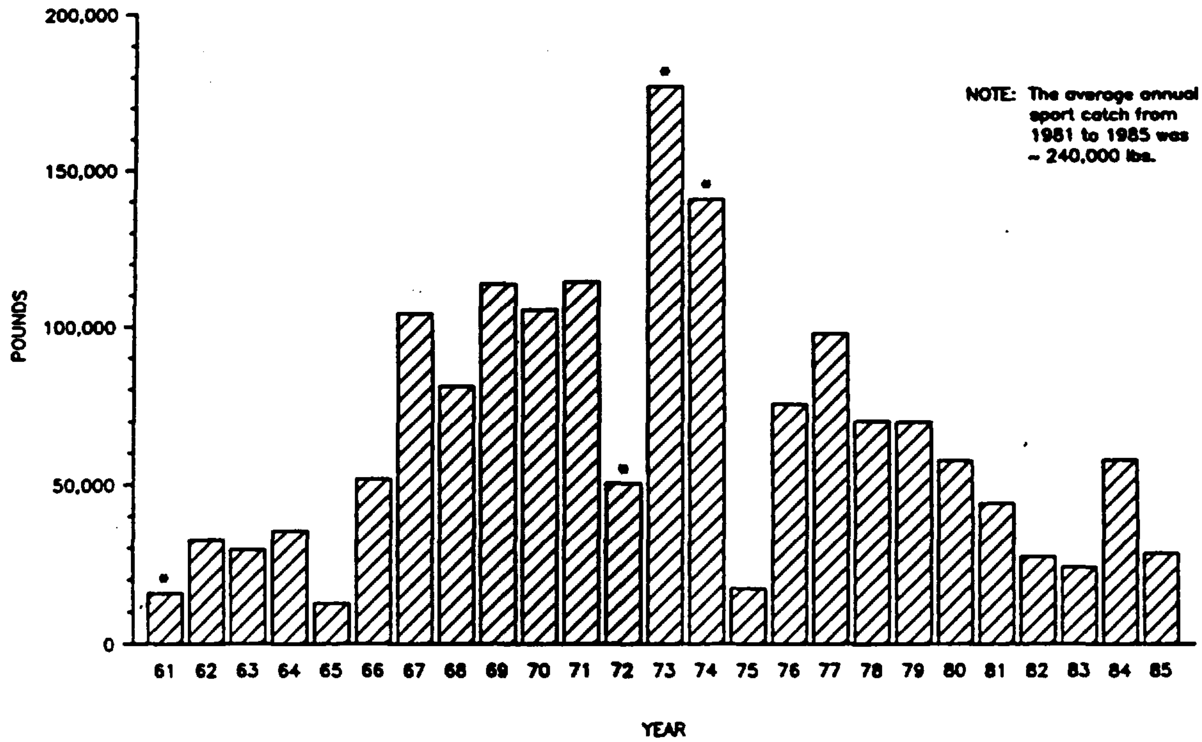
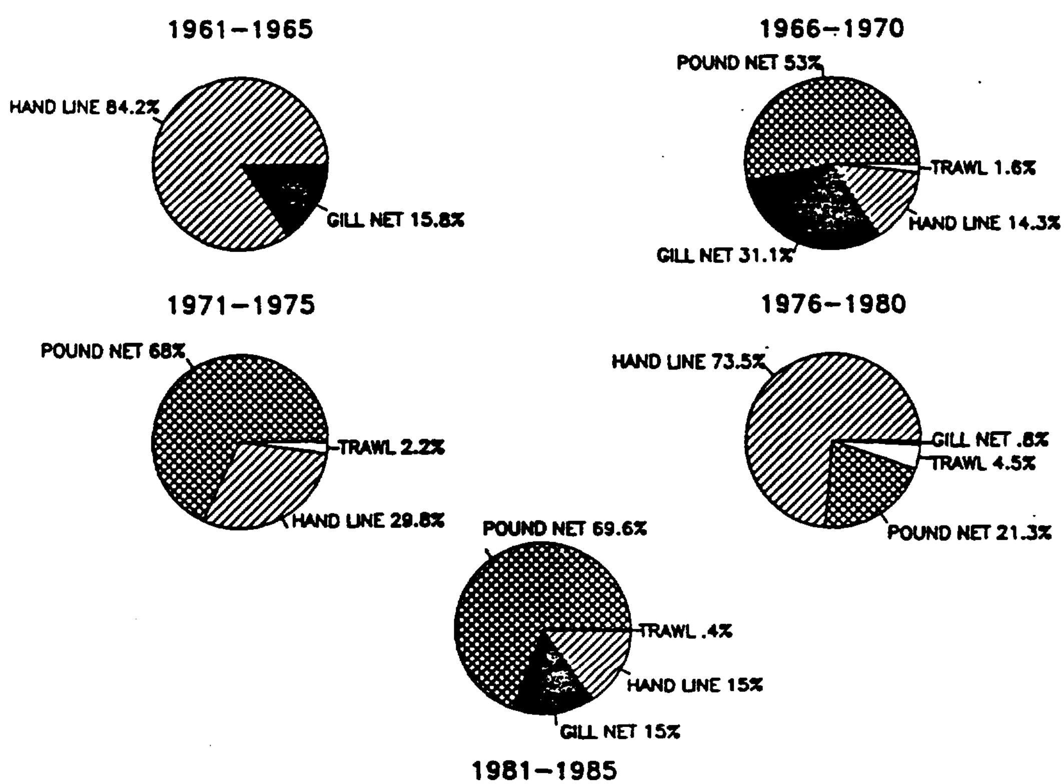
Ref. 40
36 of 45

COMMERCIAL LANDINGS OF STRIPED BASS
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




COMMERCIAL LANDINGS BY GEAR TYPE OF STRIPED BASS
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985






103210

Ref. 40
370 F45

## Summer flounder (fluke) (*Paralichthys dentatus*)

The otter trawl was used almost exclusively to take summer flounder from Long Island Sound between 1961-1985; during the early 1960's, the species was a dominant one in the commercial fishery of the Sound. From 1967-1974, pound net landings approximated 15-40% annually and, from 1977-1980, hand line landings usually ranged from 15-30% with pound net landings generally declining to less than 5%. More recently, trawl nets have accounted for most of the total.

Summer flounder landings from 1961-66 ranged from 80,000 to 150,000 lbs., then dropped to less than 80,000 lbs. for 18 years (except for 1976 and 1978). The general trend in landings follows that of the mid-Atlantic fishery, with generally low landings after the mid-1960's, except for peaks in the mid-1970's and in 1985.

Gear-specific landings from Long Island Sound in 1961 were interpolated as described previously. In Connecticut, otter trawl and hand line landings from Long Island Sound were not recorded for 1975; values were interpolated.

Otter trawl statistics for New York were missing from 1970-1975 and were interpolated with observations from 1967-69 and 1976-78. Pound net statistics were missing from 1972-1974 and were interpolated. New York hand line statistics were missing from 1961-1975. Given the length of this time period and the possibility that a fishery did not exist with this gear, interpolation could not be performed with confidence and only Connecticut values were included.

Reported recreational catches suggest that the magnitude of the sport fishery for summer flounder far exceeds the commercial with sport catches ranging between 1.0-3.9 million lbs. from 1981-85 (see "Note" in Appendix Four).

COMMERCIAL LANDINGS OF SUMMER FLOUNDER TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

GEAR TYPE

| YEAR | OTTER TRAWL | POUND NET | HAND LINE | OTHER | TOTAL LANDINGS |
|---|---|---|---|---|---|
| 1961 | 120,200* | | 900* | | 121,100* |
| 1962 | 111,300 | | 200 | | 111,500 |
| 1963 | 81,600 | | 100 | | 81,700 |
| 1964 | 91,800 | | 200 | | 92,000 |
| 1965 | 147,500 | | 400 | | 147,900 |
| 1966 | 135,400 | 6,000 | 300 | | 141,700 |
| 1967 | 32,000 | 7,900 | 400 | | 40,300 |
| 1968 | 39,600 | 11,700 | 100 | 200 | 51,600 |
| 1969 | 10,300 | 6,300 | 500 | 100 | 17,200 |
| 1970 | 15,400* | 3,500 | 100 | | 19,000* |
| 1971 | 24,500* | 5,800 | 700 | | 31,000* |
| 1972 | 17,500* | 5,300* | 400 | | 23,200* |
| 1973 | 30,200* | 4,900* | 1,800 | | 36,900* |
| 1974 | 37,500* | 14,100* | 900 | | 52,500* |
| 1975 | 52,000* | 2,800 | 700* | | 55,500* |
| 1976 | 167,500 | 6,100 | 4,600 | | 178,200 |
| 1977 | 43,600 | 4,000 | 12,500 | 100 | 60,200 |
| 1978 | 110,500 | 900 | 7,600 | 1,000 | 120,000 |
| 1979 | 20,100 | 600 | 6,600 | 500 | 27,800 |
| 1980 | 55,400 | 900 | 10,900 | 700 | 67,900 |
| 1981 | 72,700 | 800 | 1,200 | 600 | 75,300 |
| 1982 | 22,300 | 1,500 | 2,000 | 100 | 25,900 |
| 1983 | 55,000 | 4,100 | 600 | 100 | 59,800 |
| 1984 | 58,500 | 4,400 | 2,000 | 400 | 65,300 |
| 1985 | 209,700 | 3,800 | 2,500 | 100 | 216,100 |

[1] landings reported in pounds (lbs.)

* interpolated values included



103211

Ref. 40
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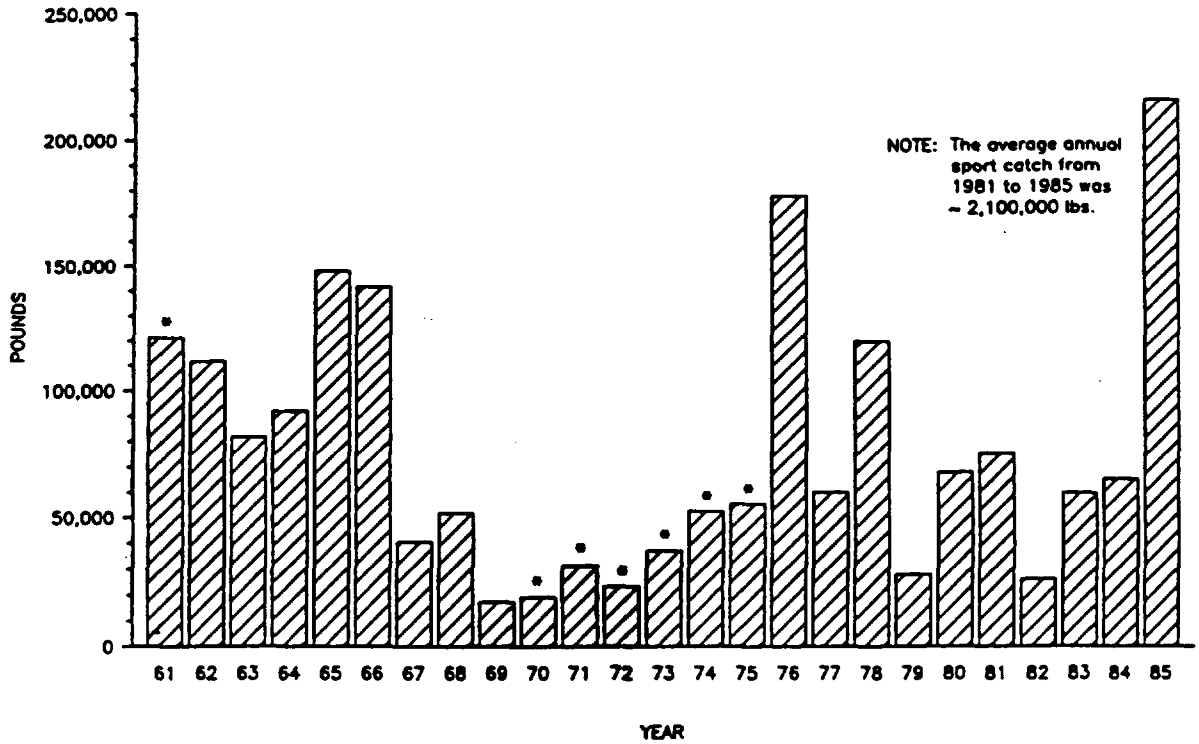
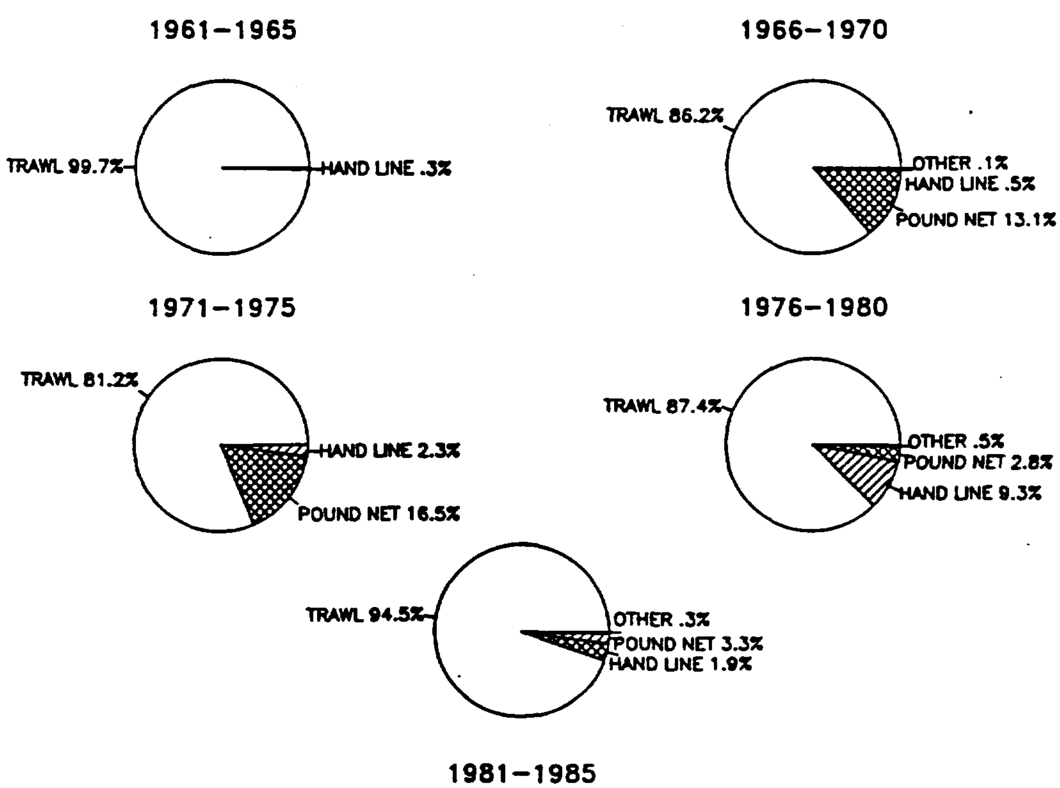
COMMERCIAL LANDINGS OF SUMMER FLOUNDER
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




COMMERCIAL LANDINGS BY GEAR TYPE OF SUMMER FLOUNDER
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985






103212

## Weakfish (squeteague) (*Cynoscion regalis*)

The weakfish is one of the few finfish species taken more frequently in the 1970's than in the 1960's and 1980's. It is also a more pelagic species than most of the others supporting the fisheries of the Sound. These observations suggest the possibility (although not confirmed by any studies of which we are aware) that a shift in species availability may have occurred in the mid-1970's which was manifested in a concomitant shift in fishery landings.

Trawl nets were initially the only gear type used, however, during the mid-1960's, the use of pound nets increased. Beginning in 1971, the hand line fishery also became important, with reported landings peaking in the late 1970's; they have since declined. Gill nets were important from 1976 to the early 1980's. Haul seines were important on eastern Long Island in the Gardiners/Peconic Bay complex. Landings have not been included here because they are known to have resulted from fisheries outside of Long Island Sound as we have defined it. The gill net and hand line fisheries likewise may be somewhat overstated in this report to the extent that some catches with these gears may have occurred in the Gardiners/Peconic Bay area.

Gear-specific landings data were not reported by water body for either state until 1962; a 1961 value for New York was interpolated from 1962-63 data. Connecticut catches of weakfish from Long Island Sound were low and intermittent throughout the 25-year period, therefore, no interpolations were made. Otter trawl statistics for New York were missing from 1970 and 1972; pound net statistics were missing from 1973 and 1974. These values were interpolated.

The recreational fishery for weakfish is a popular one in Long Island Sound, however, as with striped bass, weakfish are generally nocturnal and, therefore, the fishery is not completely sampled. Recreational catches reported in the MRFSS suggest that the sport fishery for weakfish approximates 300,000 lbs. annually; see "Note" in Appendix Four). As with striped bass, the reader is urged to exercise caution in interpreting these data.

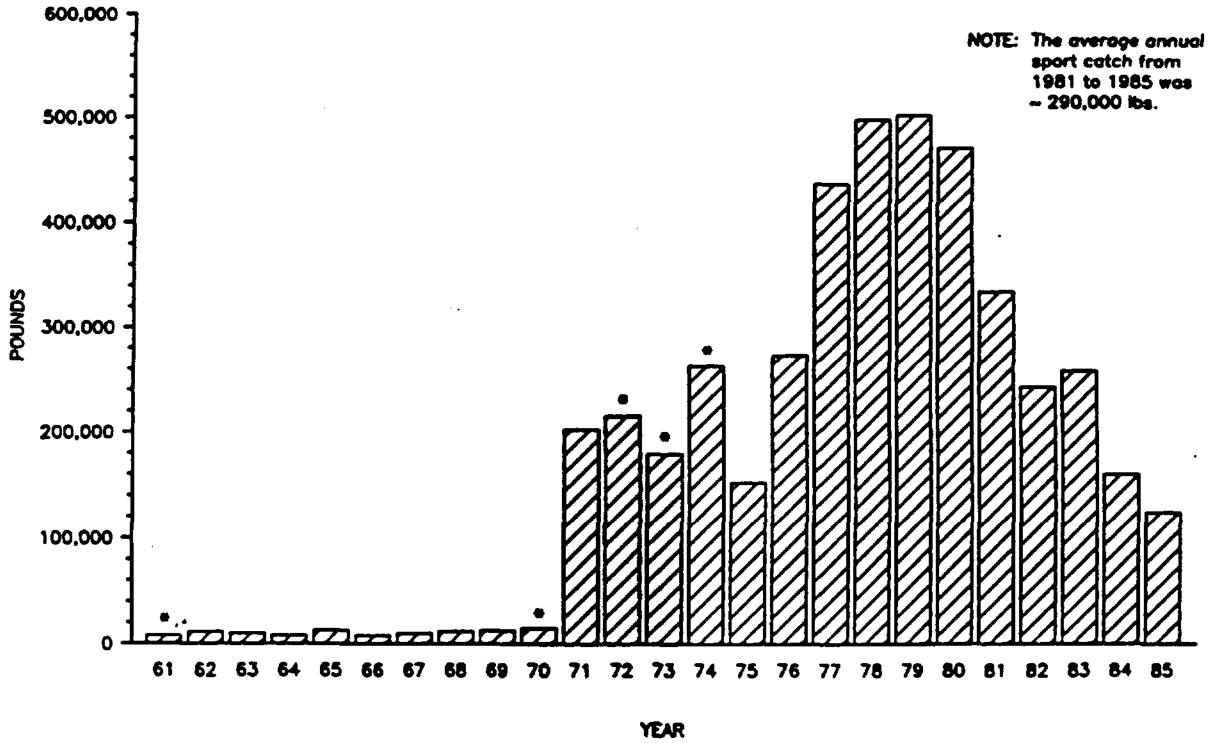
COMMERCIAL LANDINGS OF WEAKFISH TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

| | GEAR TYPE | | | | |
|---|---|---|---|---|---|
| YEAR | OTTER TRAWL | POUND NET | GILL NET | HAND LINE | TOTAL LANDINGS |
| 1961 | 7,700* | | | | 7,700* |
| 1962 | 11,300 | | | | 11,300 |
| 1963 | 9,700 | | | | 9,700 |
| 1964 | 7,700 | | | | 7,700 |
| 1965 | 12,600 | | | | 12,600 |
| 1966 | 6,700 | 900 | | | 7,600 |
| 1967 | 2,000 | 7,800 | | | 9,800 |
| 1968 | 2,000 | 9,800 | | | 11,800 |
| 1969 | 1,100 | 11,300 | | | 12,400 |
| 1970 | 3,100* | 11,700 | | | 14,800* |
| 1971 | 14,300 | 142,100 | 200 | 46,100 | 202,700 |
| 1972 | 89,100* | 65,600 | | 60,400 | 215,100* |
| 1973 | 111,800 | 33,600* | | 33,700 | 179,100* |
| 1974 | 192,300 | 38,700* | 9,400 | 22,700 | 263,100* |
| 1975 | 65,000 | 7,800 | | 78,900 | 151,700 |
| 1976 | 106,800 | 35,600 | 34,300 | 96,300 | 273,000 |
| 1977 | 187,500 | 53,900 | 50,000 | 145,200 | 436,600 |
| 1978 | 274,600 | 37,500 | 82,200 | 104,400 | 498,700 |
| 1979 | 246,300 | 40,200 | 73,700 | 142,700 | 502,900 |
| 1980 | 274,700 | 34,200 | 29,900 | 132,400 | 471,200 |
| 1981 | 118,900 | 37,400 | 90,500 | 87,300 | 334,100 |
| 1982 | 117,900 | 48,300 | 40,900 | 35,600 | 242,700 |
| 1983 | 125,900 | 23,700 | 71,300 | 37,100 | 258,000 |
| 1984 | 79,200 | 16,200 | 30,400 | 33,600 | 159,400 |
| 1985 | 78,400 | 5,700 | 16,600 | 22,900 | 123,600 |

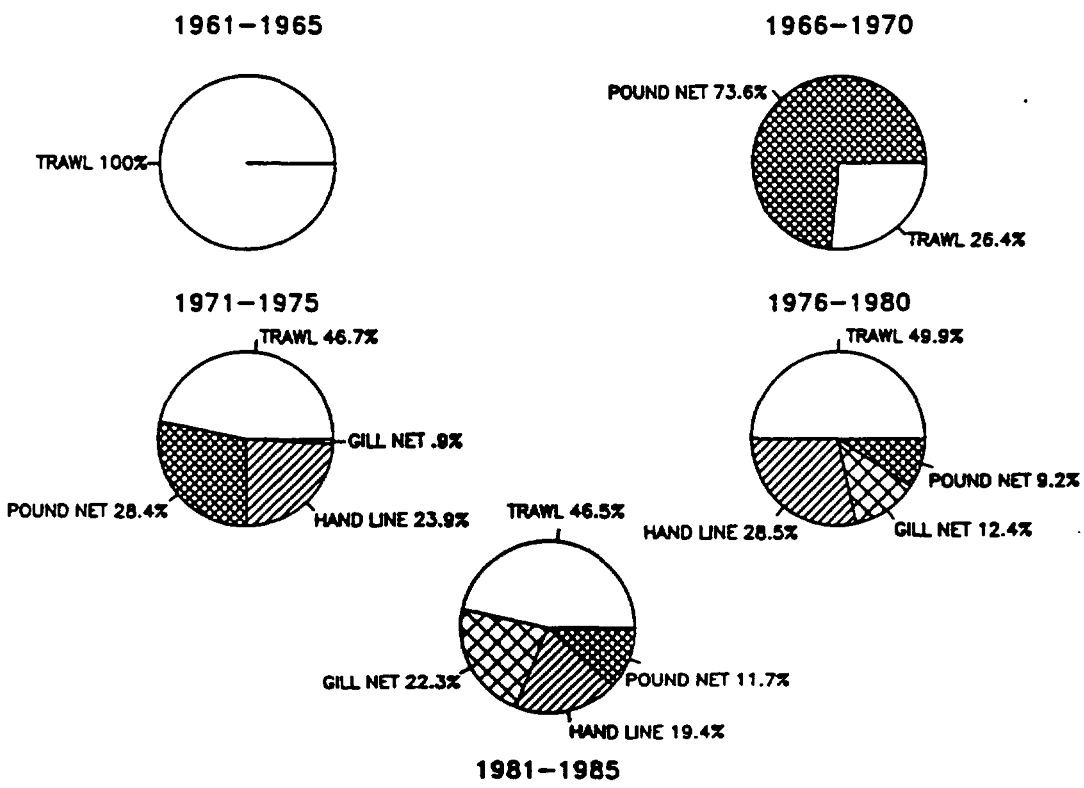
[1] landings reported in pounds (lbs.)

* interpolated values included

## COMMERCIAL LANDINGS OF WEAKFISH TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




## COMMERCIAL LANDINGS BY GEAR TYPE OF WEAKFISH TAKEN FROM LONG ISLAND SOUND, 1961 – 1985






103214

Ref. 40
41.f45

## Winter flounder (blackback) (*Pseudopleuronectes americanus*)

The winter flounder has been one of the mainstays of the commercial foodfish industry in Long Island Sound. The otter trawl was used almost exclusively to take winter flounder between 1961-1985. Hand lines were the second most prevalent gear for flounder, peaking in the mid-1970's. Hand line landings were not reported in New York prior to 1975, nor were pound net landings prior to 1967. Whether this represents missing data, or the development of new fisheries is unknown. The hand line fishery in both states, and New York pound nets, have contributed consistent but small amounts to winter flounder landings since the mid-1970's.

Long Island Sound landings of winter flounder in the mid-1980's appear to have followed the passage of a strong year class of flounder formed in the early 1980's. Historically, landings from the Sound appear to have been no more than one fourth the magnitude of the mid-1980's but this is partly believed to be an artifact of poor statistical reporting in the years prior to 1978. Nonetheless, there is little question that landings increased from 1977 to 1978; they peaked in 1984 and have since declined.

Gear-specific landings from Long Island Sound in 1961 were interpolated as described previously. Otter trawl statistics for New York were missing from 1970 and 1972-1974; pound net statistics were missing from 1972-1974. In Connecticut, otter trawl and hand line landings were absent in 1975. Values for these years were interpolated.

Reported recreational catches suggest that the sport fishery for winter flounder exceeds the commercial by almost a factor of six. Reported sport catches ranged from 2.0 million lbs. in 1982 to 4.1 million lbs. in 1985 with a peak of 4.5 million lbs. in 1984 (see "Note" in Appendix Four).

COMMERCIAL LANDINGS OF WINTER FLOUNDER TAKEN FROM LONG ISLAND SOUND, 1961-1985[1]

GEAR TYPE

| YEAR | OTTER TRAWL | HAND LINES | POUND NET | OTHER | TOTAL LANDINGS |
|---|---|---|---|---|---|
| 1961 | 160,000* | 600* | 200* | | 160,800* |
| 1962 | 143,100 | 500 | | | 143,600 |
| 1963 | 131,300 | 600 | | | 131,900 |
| 1964 | 59,600 | 2,800 | | 100 | 62,500 |
| 1965 | 190,600 | 4,600 | | | 195,200 |
| 1966 | 222,300 | 5,400 | | 600 | 228,300 |
| 1967 | 161,900 | 5,000 | 6,600 | 1,300 | 174,800 |
| 1968 | 73,400 | 4,800 | 8,000 | 2,200 | 88,400 |
| 1969 | 104,300 | 3,600 | 9,700 | 300 | 117,900 |
| 1970 | 75,600* | 4,500 | 6,600 | 1,100 | 87,800* |
| 1971 | 58,300 | 3,400 | 3,000 | 1,100 | 65,800 |
| 1972 | 33,100* | 2,100 | 3,900* | 4,600 | 43,700* |
| 1973 | 32,300* | 10,700 | 1,200* | 800 | 45,000* |
| 1974 | 22,300* | 4,700 | 600* | 8,200 | 35,800* |
| 1975 | 26,600* | 14,200* | 2,600 | | 43,400* |
| 1976 | 17,200 | 15,500 | 9,100 | 700 | 42,500 |
| 1977 | 15,900 | 4,700 | 3,800 | 800 | 25,200 |
| 1978 | 169,700 | 3,600 | 800 | 6,000 | 180,100 |
| 1979 | 105,500 | 8,000 | 300 | 4,300 | 118,100 |
| 1980 | 155,700 | 9,400 | 4,600 | 1,500 | 171,200 |
| 1981 | 302,400 | 5,300 | 2,000 | 900 | 310,600 |
| 1982 | 562,900 | 1,900 | 1,400 | 1,400 | 567,600 |
| 1983 | 631,600 | 1,000 | 3,900 | 400 | 636,900 |
| 1984 | 824,200 | 2,800 | 2,000 | 900 | 829,900 |
| 1985 | 744,800 | 3,800 | 2,000 | 2,100 | 752,700 |

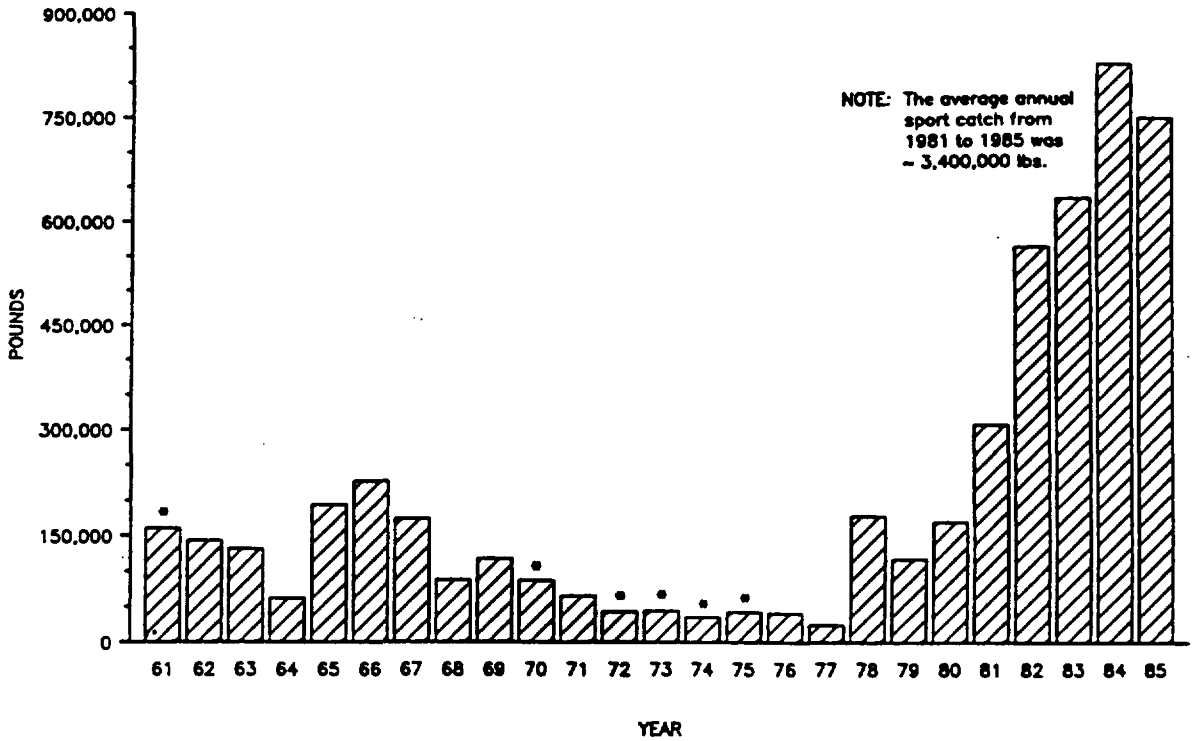
[1] landings reported in pounds (lbs.)

* interpolated values included

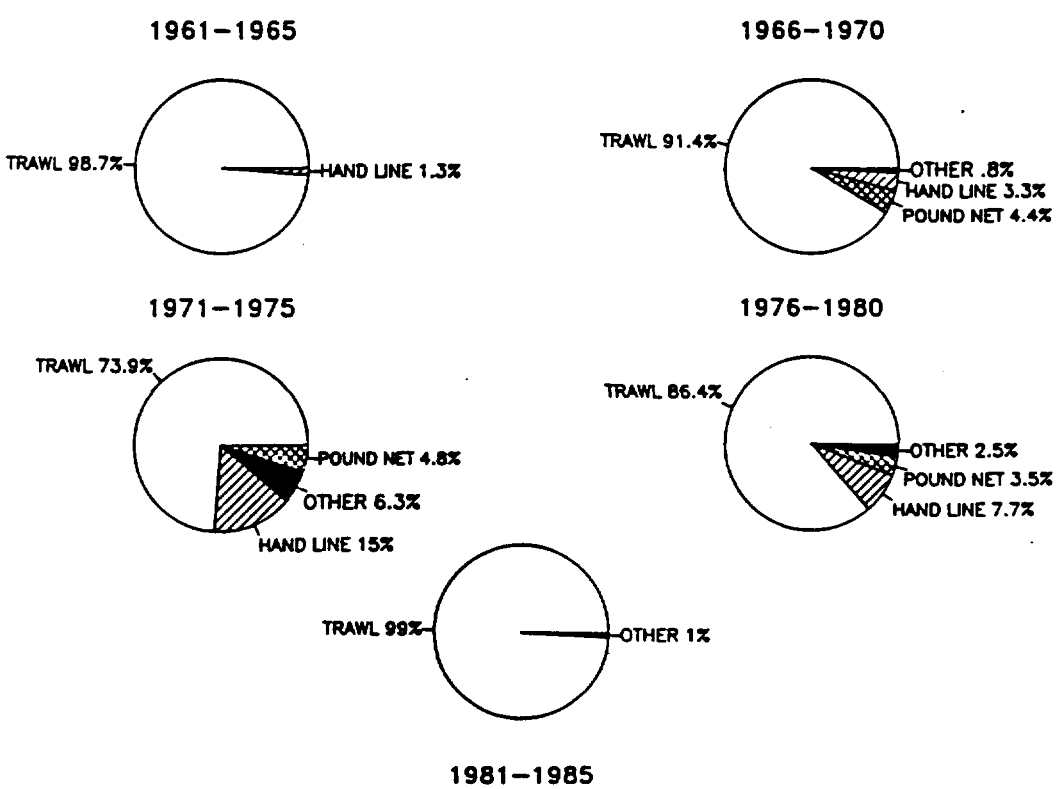


103215

COMMERCIAL LANDINGS OF WINTER FLOUNDER
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985




COMMERCIAL LANDINGS BY GEAR TYPE OF WINTER FLOUNDER
TAKEN FROM LONG ISLAND SOUND, 1961 – 1985



Ref 40
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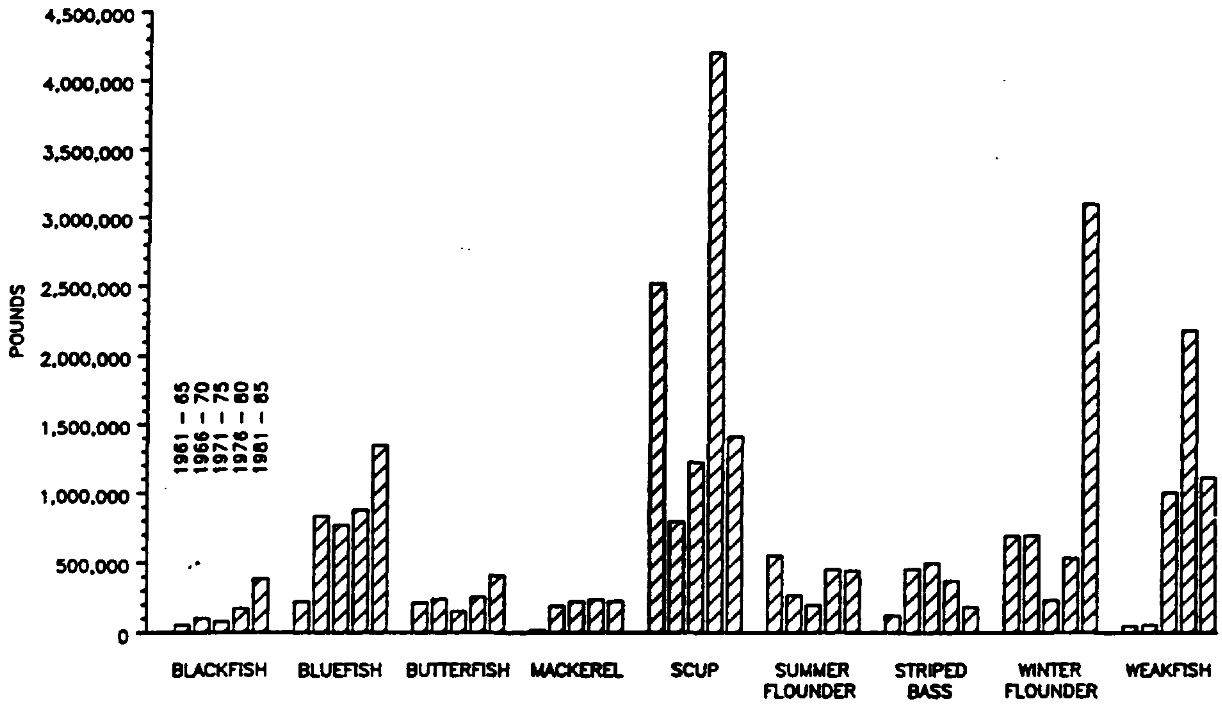
## PART TWO

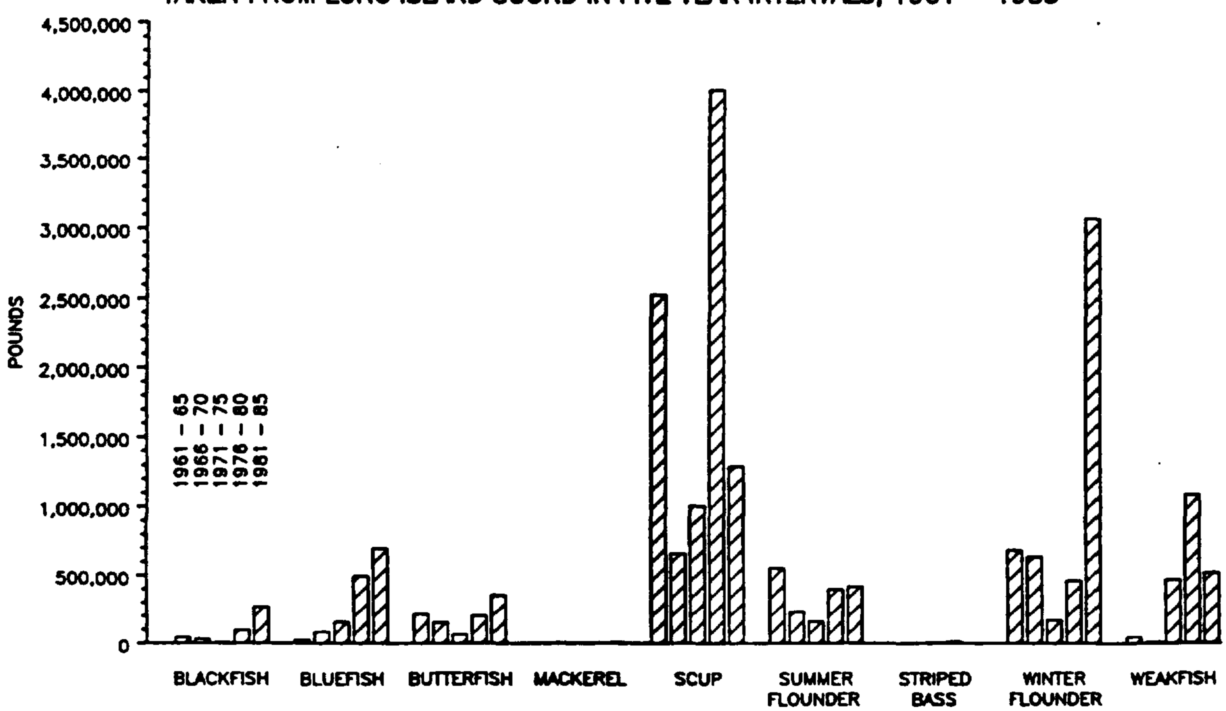
TRENDS IN LANDINGS, 1961-1985

Ref. 40
44, f45

COMMERCIAL LANDINGS BY ALL GEAR TYPES OF PRINCIPAL FINFISH
TAKEN FROM LONG ISLAND SOUND IN FIVE YEAR INTERVALS, 1961 – 1985




COMMERCIAL LANDINGS BY TRAWL OF PRINCIPAL FINFISH
TAKEN FROM LONG ISLAND SOUND IN FIVE YEAR INTERVALS, 1961 – 1985



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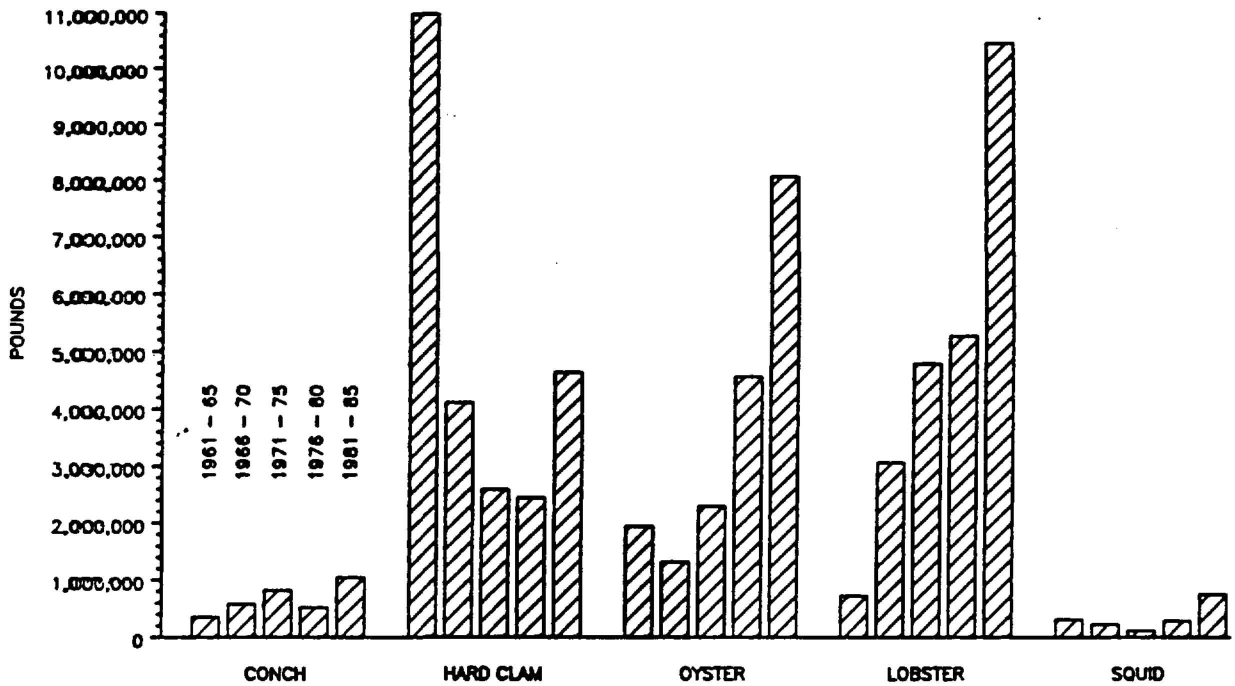
Ref. 4C
45 of 45

COMMERCIAL LANDINGS BY ALL GEAR TYPES OF SHELLFISH, LOBSTER, AND SQUID TAKEN FROM LONG ISLAND SOUND IN FIVE YEAR INTERVALS, 1961 – 1985



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REFERENCE 41

Ref.-41
1.F11

Biological Services Program

FWS/OBS-80/51
September 1980

# Atlantic Coast Ecological Inventory

## USER'S GUIDE AND INFORMATION BASE





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U.S. Department of the Interior

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2 of 11

FWS/OBS-80/51
September 1980

# ATLANTIC COAST ECOLOGICAL INVENTORY USER'S GUIDE AND INFORMATION BASE

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Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| RHODE ISLAND (cont'd) | | | | | | |
| South Shore Management Area | | X | | X | | |
| Trustom Pond National Wildlife Refuge | X | | | X | | |
| Block Island National Wildlife Refuge | X | | | X | | |
| Block Island State Beach | | X | | | | X |
| Ninigret Conservation Area | | X | | X | | |
| Ninigret National Wildlife Refuge | X | | | X | | |
| Kimball Bird Sanctuary | | | X | X | | |
| Burlingame State Park | | X | | | | X |
| Burlingame Management Area | | X | | X | | |
| Indian Cedar Swamp Management Area | | X | | X | | |
| Carolina Management Area | | X | | X | | |
| Woody Hill Management Area | | X | | X | | |
| CONNECTICUT | | | | | | |
| Pachaug State Forest | | X | | X | | X |
| Assekonk Swamp State Forest | | X | | X | | X |
| Bluff Point State Park | | X | | | | X |
| Fort Griswold State Park | | X | | | X | |
| Stoddard Hill State Park | | X | | | | X |
| Fort Shantok State Park | | X | | | X | |
| Harkness Memorial State Park | | X | | | X | |
| Rocky Neck State Park | | X | | | | X |
| Nehantic State Forest | | X | | X | | X |
| Dart Island State Park | | X | | | | X |

continued





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Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| CONNECTICUT (cont'd) | | | | | | |
| Hurd State Park | | X | | | | X |
| George D. Seymour State Park | | X | | | | X |
| Haddam Island State Park | | X | | | | X |
| Haddam Meadow State Park | | X | | | | X |
| Brainard Homestead State Park | | X | | | X | |
| Gillette Castle State Park | | X | | | X | |
| Selden Neck State Park | | X | | | | X |
| Salt Meadow National Wildlife Refuge | X | | | X | | |
| Cockaponset State Forest | | X | | X | | X |
| Chatfield Hollow State Park | | X | | | | X |
| Hammonasset Beach State Park | | X | | | | X |
| Trimountain State Park | | X | | | | X |
| Wharton Brook State Park | | X | | | | X |
| Quinipiac River State Park | | X | | | | X |
| Sleeping Giant State Park | | X | | | | X |
| Naugatuck State Forest | | X | | X | | X |
| Silver Sands State Park | | X | | | | X |
| Osbornedale State Park | | X | | | | X |
| Sherwood Island State Park | | X | | | | X |
| NEW YORK | | | | | | |
| Planting Fields Arboretum State Park | | X | | | | X |
| *Oyster Bay National Wildlife Refuge | X | | | X | | |
| *Caumsett State Park | | X | | | | X |

continued





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Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| NEW YORK (cont'd) | | | | | | |
| *Target Rock National Wildlife Refuge | X | | | X | | |
| Sunken Meadow State Park | | X | | | | X |
| Nissequogue River State Park | | X | | | | X |
| Brookhaven State Park | | X | | | | X |
| Wildwood State Park | | X | | | | X |
| Conscience Point National Wildlife Refuge | X | | | X | | |
| Elizabeth Alexandra Morton National Wildlife Refuge | X | | | X | | |
| Orient Beach State Park | | X | | | | X |
| Hither Hills State Park | | X | | | | X |
| Montauk Point State Park | | X | | | | X |
| Amagansett National Wildlife Refuge | X | | | X | | |
| Fire Island National Seashore | X | | | X | | X |
| Wertheim National Wildlife Refuge | X | | | X | | |
| Smith Point County Park | | | X | | | X |
| Connetquot River State Park | | X | | | | X |
| Bayard Cutting Arboretum State Park | | X | | | | X |
| Heckscher State Park | | X | | | | X |
| Seatuck National Wildlife Refuge | X | | X | | | |
| Robert Moses State Park | | X | | | | X |
| Captree State Park | | X | | | | X |
| Gilgo State Park | | X | | | | X |
| Belmont Lake State Park | | X | | | | X |
| Bethpage State Park | | X | | | | X |

continued

Table 8 (continued).

| Name | Ownership/Administration | | | Special significance | | |
|---|---|---|---|---|---|---|
| | Federal | State | Private/ Local | Natural/ Ecological | Historic/ Cultural | Recreational |
| NEW YORK (cont'd) | | | | | | |
| Massapequa State Park | | X | | | | X |
| Jones Beach State Park | | X | | | | X |
| Hempstead Lake State Park | | X | | | | X |
| Valley Stream State Park | | X | | | | X |
| Jamaica Bay Wildlife Refuge | X | | | X | | |
| Martin Van Buren National Historic Site | X | | | | X | |
| Bristol Beach State Park | | X | | | | X |
| Clermont State Park | | X | | | | X |
| Mills Memorial State Park | | X | | | X | X |
| Margaret Lewis Norrie State Park | | X | | | | X |
| Vanderbilt Mansion National Historic Site | X | | | | X | |
| Franklin Delano Roosevelt Home National Historic Site | X | | | | X | |
| Hudson Highlands State Park | | X | | | | X |
| Bear Mountain State Park | | X | | | | X |
| Harriman State Park | | X | | | | X |
| Stony Point State Park | | X | | | | X |
| Haverstraw Beach State Park | | X | | | | X |
| Rockland Lake State Park | | X | | | | X |
| Hook Mountain State Park | | X | | | | X |
| Nyack Beach State Park | | X | | | | X |
| Tallman Mountain State Park | | X | | | | X |
| Statue of Liberty National Monument | X | | | | X | |

continued





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Table 9. Species with special status in the Middle Atlantic Zone.

| a- o | Species | Federal Endangered | Federal Threatened | State Endangered | State Threatened |
|---|---|---|---|---|---|
| | FISH | | | | |
| 10 | Shortnose sturgeon | X | | | |
| 1] | Atlantic sturgeon | | | VA | NJ |
| 1( | American shad | | | | NJ |
| )0 | Maryland darter | X | | | |
| | AQUATIC REPTILES AND AMPHIBIANS | | | | |
| )1 | Green sea turtle | | X | | |
| )2 | Loggerhead sea turtle | | X | | |
| )3 | Hawksbill turtle | X | | | |
| )4 | Atlantic ridley turtle | X | | | |
| )5 | Leatherback turtle | X | | | |
| | MARINE MAMMALS | | | | |
| ›7 | Right whale | X | | | |
| | Sei whale | X | | | |
| | Humpback whale | X | | | |
| | Blue whale | X | | | |
| | Fin whale | X | | | |
| | Sperm whale | X | | | |
| | PLANTS | | | | |
| 8 | Prickly pear cactus* | | | | |
| 9 | Trailing arbutus* | | | | |
| 8 | Ebony spleenwort* | | | | |
| 9 | Orchids* | | | | |
| 0 | Golden club* | | | | |

Sp cies is legally protected in New York, but has not been specifically designated as a threatened or endangered species.

continued



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Table 9 (continued).

| Map No. | Species | Federal Endangered | Federal Threatened | State Endangered | State Threatened |
|---|---|---|---|---|---|
| | BIRDS | | | | |
| 406 | Least tern | | | NJ | |
| 407 | Roseate tern | | | | NJ |
| 412 | Black skimmer | | | NJ | |
| 437 | Great blue heron | | | | NJ |
| 441 | Yellow-crowned night heron | | | | NJ |
| 505 | Bald eagle | X | | | |
| 506 | Osprey | | | NY, NJ | |
| 507 | Peregrine falcon | X | | | |
| 508 | Cooper's hawk | | | NJ | |
| 510 | Marsh hawk | | | NJ | |
| | TERRESTRIAL REPTILES AND AMPHIBIANS | | | | |
| 607 | Bog turtle | | | NY, NJ, MD | |
| 609 | Eastern tiger salamander | | | NJ, MD | |
| 621 | Pine barrens tree frog | | | NJ | |
| 622 | Northern pine snake | | | | NJ |
| 623 | Corn snake | | | | NJ |
| 624 | Timber rattlesnake | | | NJ | |
| 625 | Southern gray tree frog | | | | |
| | TERRESTRIAL MAMMALS | | | | |
| 722 | Delmarva fox squirrel | X | | | |

concluded



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Terrestrial Resources

Terrestrial and biotic resources of this subsection are protected by numerous parks and management areas.

a. Widespread species. Important bird concentration areas are scattered throughout the section and are identified below. Mammals are distributed evenly in the area, but occur in such limited numbers that their densities are not significant.

b. Geographic inventory. Between grid references DR26 and CR67 are several shorebird and wading bird nesting areas as well as waterfowl migratory areas. The most significant portion of this interval is Muskeget Island (grid reference CR97) which supports shorebirds, marsh hawks, short-eared owls, and the only known population of beach meadow voles. This species of vole has been proposed as an endangered species.

Between grid references CR56 and BR95 are other important shorebird and wading bird areas; several areas with osprey nests also are shown. A special interest area is Bird Island (grid reference CS51), which supports approximately 40 percent of the U.S. breeding population of roseate terns (900 pairs). The three largest colonies of this species represent approximately 95 percent of the breeding population.

The next interval of importance (grid reference BR85) is the Block Island area. Because of its remoteness Block Island supports a variety of terrestrial species, including wading birds, shorebirds, migrating waterfowl and songbirds, and marsh hawks. The endangered peregrine falcon is a common visitor to Block Island during its migration. This island is one of the few areas the falcon is known to use regularly. Also, the only known population of the Block Island meadow vole is found on the island. This vole also has been proposed for inclusion on the Federal endangered species list.

5.3.2 Long Island Sound (Grid Reference BR55 to XA02)

This subsection encompasses the Long Island Sound and adjacent shoreline of Connecticut and New York, as well as the northern shore of Long Island. The Long Island Sound estuary is a semi-enclosed body of water measuring 145 kilometers (90 miles) long and 24 kilometers (15 miles) wide. The sound opens to Block Island Sound and the Atlantic Ocean on the east, and is fed by the East River, a part of the Hudson estuary, on the west (figure 5). Long Island Sound is a moderately stratified estuary dominated by strong tidal currents and freshwater inflow on its northern side. Several rivers (the largest being the Connecticut River) drain into the sound from the north shore, but most of this water is rapidly exchanged with the Atlantic Ocean. The bays which separate the northern and southern tips of eastern Long Island, principally Flanders, Great Peconic, Little Peconic, and Gardiners Bays, also are included as a part of this section.

Aquatic Resources

a. Widespread species. Throughout Long Island Sound, the occurrence of the major commercially and recreationally important organisms is dependent on seasonal changes in water temperature. Sessile invertebrates, such as bay scallops, Rev. 10 of 11

oysters, and hard and soft clams, are located in beds throughout the Long Island Sound region. Oysters are one of the most valuable commercial fisheries in the Long Island Sound estuary.

Several fish species are year-round residents, including the winter flounder, one of the most abundant fish, tautog, and cunner. The latter two species are mainly fished for recreation. Coldwater species, such as cod and pollock, move into the sound from waters during the winter while more temperate water species, such as bluefish, scup, summer flounder, striped bass, and weakfish, inhabit the area during the summer. Anadromous fish, such as American shad, blueback herring, alewife, and the endangered shortnose sturgeon inhabit the sound and coastal tributaries during their spawning migrations.

b. Geographic inventory. The eastern end of the Long Island Sound subsection (grid reference BR55) provides winter habitat for cod and pollock populations, which generally inhabit cold offshore bottom waters. This area represents the southernmost point where large numbers of pollock occur inshore. Cod move offshore in March and April and pollock leave in June.

The Connecticut River (grid reference YA27) is a major anadromous fish spawning stream. The Federally endangered shortnose sturgeon migrates up this river; in 1977, the total adult population in the river was estimated at 450 fish. Alewife, American shad, rainbow smelt, and American tomcod also migrate up the Connecticut River to spawn.

The Peconic-Gardiners Bay Complex (grid references YA03 to YA35) is one of the more important northern centers for concentrations of weakfish. Weakfish use this complex as a spawning, nursery, and feeding ground. Shellfish also are abundant in this complex; some of the major mid-Atlantic coast bay scallop beds are located in the shallows and eelgrass beds of this area. Hard clams and oysters also are abundant.

Although other shallow water, hard bottom areas have important commercial oyster populations, Oyster Bay (grid reference XA23) is one of the more productive areas. Much of the oyster fishery in Long Island Sound, including Oyster Bay, is maintained by hatchery seed production and intensive bed management.

Terrestrial Resources

a. Widespread species. The characteristic upland habitats on Long Island are the pitch pine and scrub oak forests and the extensive tidal wetlands which occur throughout the coastal areas. Several common wading bird and shorebird species inhabit the wetland areas during the spring and summer months. These species, and estimates of nesting pairs, include great black-backed gull (1,400 pairs), herring gull (5,400 pairs), common tern (3,100 pairs), least tern (1,400 pairs), roseate tern (800 pairs), black-crowned night heron (600 pairs), snowy egret (200 pairs), and glossy ibis (30 pairs).

b. Geographic inventory. An especially important wildlife area of Long Island, between grid references YA15 and YA55, contains many species, including nesting wading birds, shorebirds, songbirds, and ospreys. During fall and early winter, many songbirds and wintering hawks reside near the sound. A majority of the great black-backed and herring gulls of the zone nest in this locality. In

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addition, the bog turtle, which is an endangered species in New York, breeds in this area. Peregrine falcons are known to frequent the area to the west (grid reference XA52) during migrations.

In spring, northern Nassau County (grid reference XA12 to XA31) is the focal point for many migratory birds, especially songbirds; several raptors nest in the county on a seasonal basis. In winter, many ducks and geese remain in the bays and marshes. Osprey, an endangered species in New York, also nests in this area.

## 5.4 NEW YORK BIGHT (GRID REFERENCE BR55 TO WU00)

This section encompasses the exposed outer coast from Montauk Point, New York, to Cape May, New Jersey, and the Hudson River. The New York Bight has been divided into three subsections: the South Shore of Long Island, the Hudson River, and the New Jersey Shore.

### 5.4.1 South Shore of Long Island (Grid Reference BR55 to WV98)

The South Shore of Long Island, from Montauk Point on the east to Sea Gate on the west, is dominated by barrier islands which protect an extensive system of bays and marshes on their landward side. This system includes Jamaica, Great South, Moriches, and Shinnecock Bays. The biotic resources for this subsection are keyed geographically using north-south UTM grid swaths.

#### Aquatic Resources

a. Widespread species. The South Shore of Long Island is an extremely critical area for spawning and nursery grounds as well as beds for major commercial and recreational shellfish and finfish, such as hard clam, bay scallop, soft shell clam, Atlantic menhaden, weakfish, striped bass, winter and summer flounder, and bluefish. Other fishery species are the surf clam, scup, Atlantic mackerel, and two coldwater species, cod and pollock, which move inshore during the summer. Species of special status which inhabit these coastal waters include six marine mammals, five sea turtles, and one fish (table 9). At the interface between the complex and the ocean, lobsters and mussels inhabit rocky areas.

b. Geographic inventory. Cod and pollock generally are coldwater, offshore bottom species, but during the fall individual schools move inshore. Both species may remain through the winter; cod move offshore in March and April and pollock leave in June. Montauk Point (grid reference BR65) is the southernmost area where large numbers of adult pollock occur nearshore.

The eastern portion of Long Island's South Shore, from Montauk Point to Moriches Inlet (grid reference BR65 to XA81), harbors an abundance of marine species, such as bluefish, striped bass, and black sea bass, which move inshore during the spring and summer. These species are not only of commercial value, but they also are of even greater recreational importance. Adult bluefish inhabit nearshore waters, but the eastern portion of the South Shore of Long Island is one of the few places along the Atlantic coast where bluefish can be caught from shore. Striped bass occur and are harvested along the entire Long Island South Shore. However, after adults spawn during the spring in the Hudson River, their largest summer concentrations are along the eastern portion of the subsection.

103231

REFERENCE NO. 42

Nassau County Department of Health

# GROUND WATER AND PUBLIC WATER SUPPLY FACTS

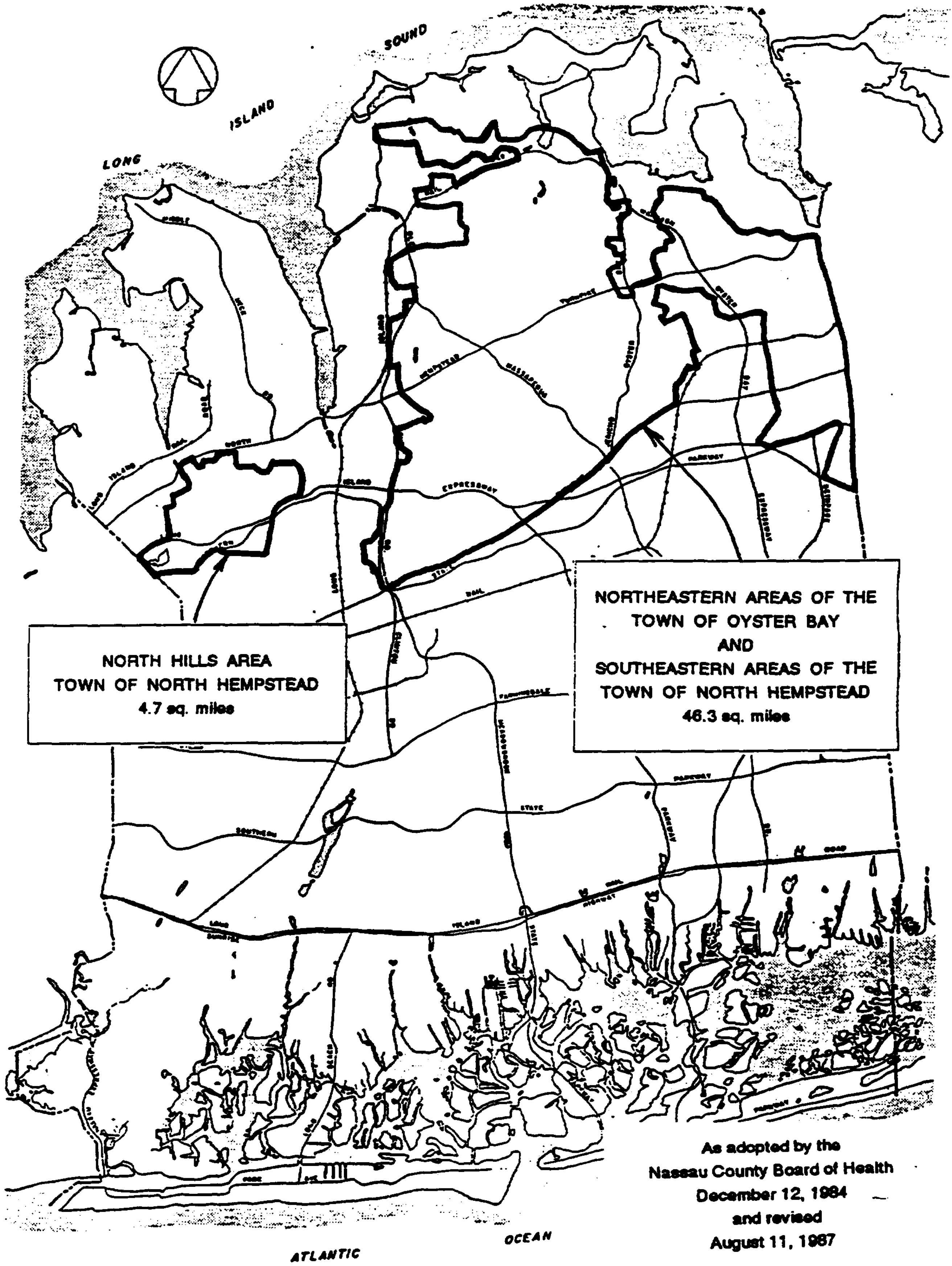
OCTOBER 1993


THOMAS S. GULOTTA
COUNTY EXECUTIVE

ABBY J. GREENBERG, M.D.
ACTING COMMISSIONER

## NASSAU COUNTY DEPARTMENT OF HEALTH

# SPECIAL GROUNDWATER PROTECTION AREAS
# NCPHO ARTICLE X

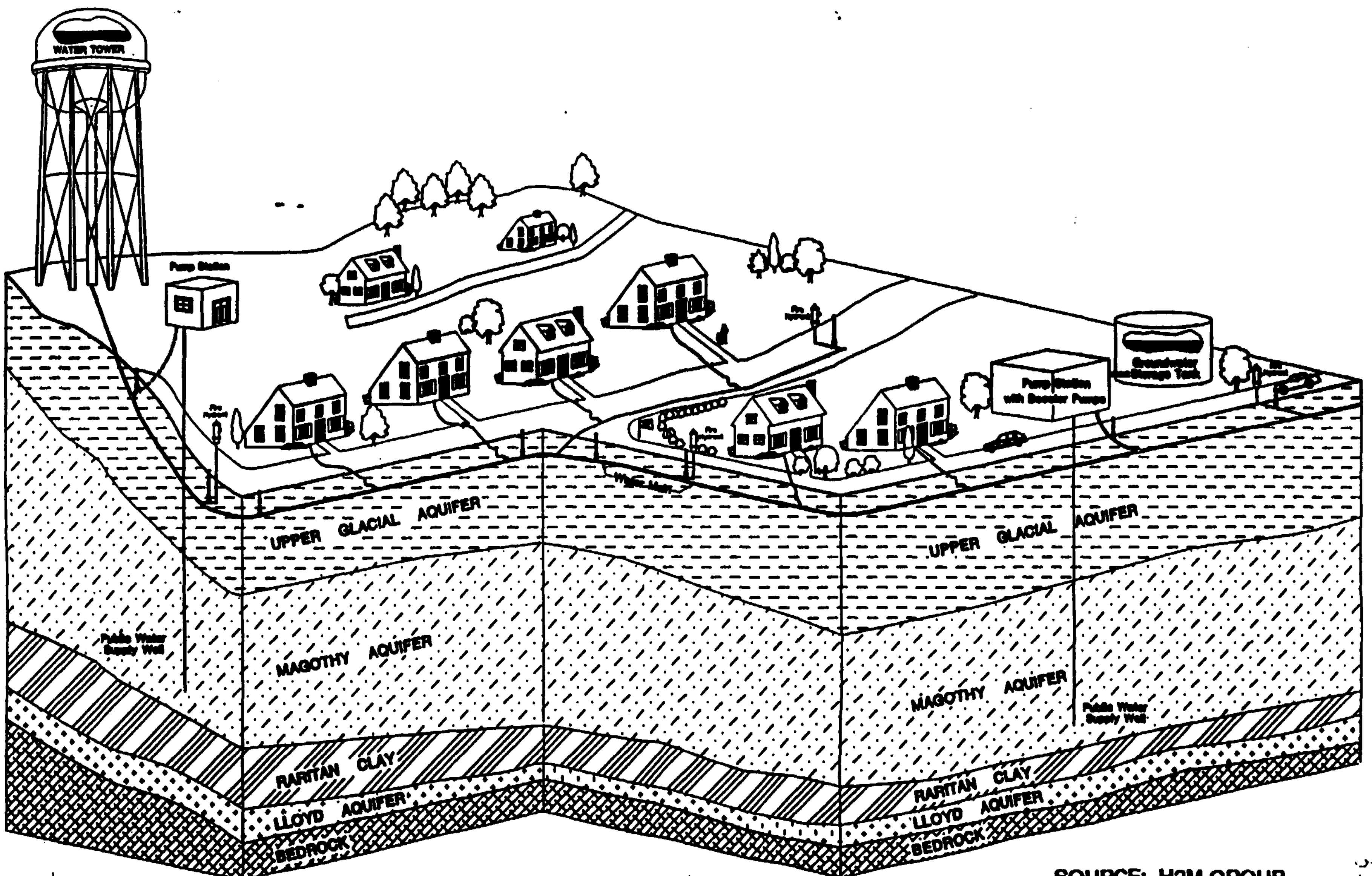



As adopted by the
Nassau County Board of Health
December 12, 1984
and revised
August 11, 1987

103234

NASSAU COUNTY DEPARTMENT OF HEALTH

## TYPICAL PUBLIC WATER SYSTEM ON LONG ISLAND




SOURCE: H2M GROUP
Melville, New York

103235

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NASSAU COUNTY DEPARTMENT OF HEALTH

# PUBLIC WATER SUPPLY AND MONITORING WELLS IN NCDH MONITORING SYSTEM

DECEMBER 31, 1992

| TYPE OF WELL | PUBLIC WATER SYSTEMS | TOTAL WELLS | GLACIAL WELLS | MAGOTHY WELLS | LLOYD WELLS | OTHER WELLS (a) |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| 1. PUBLIC | | | | | | |
| a. COMMUNITY | 51 | 406 | 35 | 328 | 39 | 4 |
| b. NON-COMMUNITY | 7 | 15 | 5 | 9 | 1 | 0 |
| TOTAL | 58 | 421 | 40 | 337 | 40 | 4 |
| 2. NON-PUBLIC | | | | | | |
| a. MONITORING (b) | – | 447 | 281 | 150 | 11 | 5 |

(a) Other includes the Jameco and Port Washington Aquifers.

(b) Monitoring wells include only those NCDPW observation wells, private industrial, air conditioning or irrigation wells, or special groundwater investigation wells tested by the NCDH for water quality.

DEFINITIONS:

1. Public Water System means either a community or non-community system which provides piped water to the public for human consumption, if such system has at least five service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year.

2. Community Water System means a public water system which serves at least five service connections used by year-round residents or regularly serves at least 25 year-round residents.

3. Non-Community Water System means a public water system that is not a community water system.

REFERENCE NO. 43

U.S. DEPARTMENT OF COMMERCE
Luther H. Hodges, Secretary

WEATHER BUREAU
F. W. Reichelderfer, Chief

# TECHNICAL PAPER NO. 40

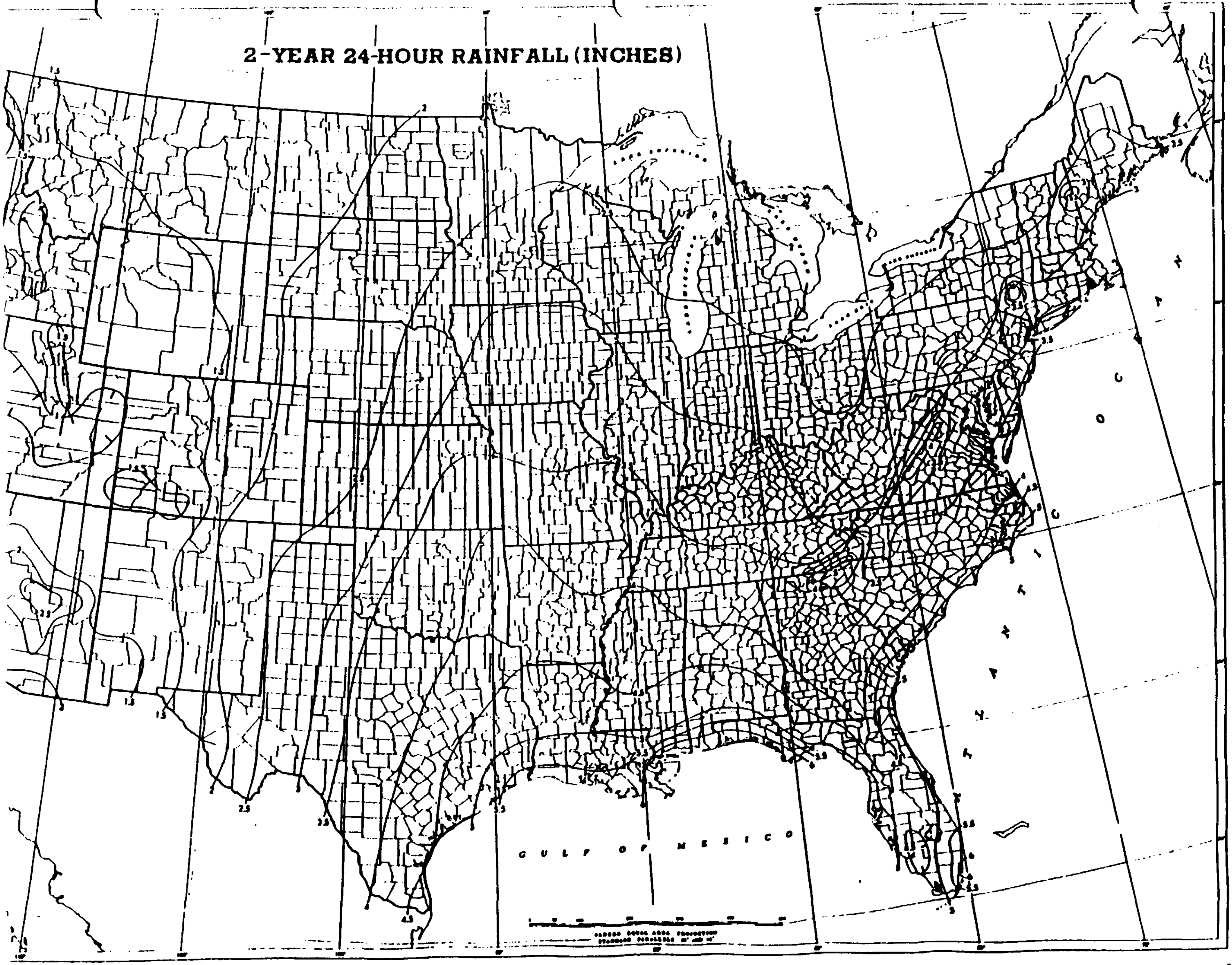
# RAINFALL FREQUENCY ATLAS OF THE UNITED STATES

## for Durations from 30 Minutes to 24 Hours and Return Periods from 1 to 100 Years

Prepared by
DAVID M. HERSHFIELD
Cooperative Studies Section, Hydrologic Services Division
for
Engineering Division, Soil Conservation Service
U.S. Department of Agriculture

1963

# 2-YEAR 24-HOUR RAINFALL (INCHES)




103239

REFERENCE NO. 44

# DOCUMENTATION FOR WETLANDS CALCULATIONS

The following procedures were used to determine the wetlands values for the surface water and air pathways.

## Surface Water Pathway

A map wheel, set to the same scale as the National Wetlands Inventory Maps' scale, was used to measure the wetlands frontage along the surface water stream segments. Only the eligible wetlands, as defined in the U.S.EPA Hazard Ranking System Guidance Manual, November 1992, Highlight A-8, were measured for the surface water pathway.

## Air Pathway

A transparent grid, with one acre grids which corresponded to the National Wetlands Inventory Maps' scale, was overlain on the NWI maps and the acreage was tabulated for each radii in the study area. Only the eligible wetlands, as defined in the U.S.EPA Hazard Ranking System Guidance Manual, November 1992, Highlight A-8, were measured for the surface water pathway.